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Journal of the Society of Arts.

FRIDAY, FEBRUARY 1, 1856.

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EIGHTH ORDINARY MEETING.

Wednesday, January 30, 1856.

The Eighth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 30th instant, J. Allen Ransome, Esq., in the chair.

The following Candidates were balloted for and duly elected :—

Acland, Henry Wentworth, M.D.
Dent, Stanley
Dunn, Joseph Arnold
Girdwood, John
Green, James Allen
Hall, Walter
Hawksworth, William
Hicks, John
Kennard, Robert William
Lawrence, Charles
Levick, Frederick
Maris, Andrew
Orr, Capt. Andrew S., R.A.
Rusby, William John
Sturge, Edmund
Tolhausen, Alexander
Wilson, John

As a Corresponding Member.
Hulot, Anatole.

The paper read was

ON CULTIVATION BY STEAM; ITS PAST HISTORY AND PROBABLE PROSPECTS.

By John Fowler, Jun. (of Bristol).

The importance of the subject we have met this evening to consider, is now almost universally acknowledged; it is a question affecting an expenditure of at least fifty millions sterling annually—the cost of horse labour in agriculture; and its progress is anxiously watched by men who, even three years ago, would have been sceptical of its ever attaining any practical value. Not long since it was the common remark, among both engineers and agriculturists, that, though steam cultivation was probably practicable, yet the cost of ploughing by horse-power was not sufficient to render it remunerative or likely to be generally adopted. But the experience of the last few years, and the advantages that have accrued from the more rapid and perfect execution of barn work by steam-power, have tended to lead the agriculturists to set a different value upon it; and I believe that that body are now quite prepared to give a warm welcome to any means that will give them greater power over the material with which they have to deal, and that will enable them to cultivate the soil more expeditiously and thoroughly, even should there be but little economy over the present plans. In an uncertain climate like our own, time is more essentially money in dealing with the soils than in almost any other operation we can name; and, if that axiom is found universally to hold good in its application to every other sphere of human industry, it must be doubly applicable to the cultivation of the soil, where the loss of a week is often a serious injury to a crop. Of course, economy would be a great desideratum, and I hope to be able to show that cultivation by steam-power may be performed at a little over half the cost of horse labour; but I do not think that this is absolutely essential to its extended adoption.

The change in public opinion to which I have alluded, and which I think I may safely reckon upon, will render it unnecessary for me to endeavour to show its importance, or to do more than allude to one or two matters that may give a more pointed direction to our inquiries.

The work of a farm may be divided into two classes—Field operations, and the cartage of corn, manure, &c., &c. Steam, in its present state, may be easily applied to the former of these, but its application to the latter is still surrounded more, I believe, with the mist of inexperience than with mechanical difficulty. The horses required upon a farm may be materially reduced by the assistance of steam in field operations, and those operations may be, as before stated, more rapidly and thoroughly performed; yet, until steam is also available for carting, it can only be regarded as an important auxiliary; and, though the half loaf may be better than no bread, yet the possession of the first half only renders the other half still more valuable and necessary.

Thus we have to seek the solution of two mechanical problems—first, the application of steam to field operations; second, to the carting and harvest operations of a *farm*. The harvest operations may, possibly, be brought under the head of field operations, and executed by the same machinery; if so, we shall, unquestionably, have gained the largest half of our loaf.

Having thus referred to the points that seem most to require our present attention, I will now ask you to follow me through the past history of our subject, a history that bears an exact resemblance to that of all the great mechanical realities of our age,—the steam-boat, the railway, and even the steam-engine itself; except in the fact that the greater talents, means, and energies that have been devoted to those subjects, have succeeded in more rapidly developing them into great facts. Time will not allow me to trace the resemblance as accurately as I should like. I think it would encourage us to look forward with perfect confidence to a similar reward to our labours in this direction, and one not less important than the best of them, but I must content myself with remarking that its birth was coeval with theirs; like them, 200 years ago, it commenced in the minds of those who are more poets than mechanics, who overleap all practical difficulties, and to whom thoughts are realities.

Every new mind gave greater tangibility to the crudeness of the first conception, until, in our own time, every possible idea seems again and again to have been remodelled and served up with some new lights, but, unlike them, no master spirit has as yet taken this undigested mass and given tangible shape and practical value to their *ideas*. Accompanying this is an abstract of all the patents that have yet been taken out bearing on the question of steam cultivation, with a short notice of their peculiarities, for which I am indebted to Mr. Burness, of the *Mark Lane Express*, and to this I must refer you for detailed information.

There are fifty-five here enumerated, which may be all classed under the following heads:—

1st. Locomotive engines used for drawing agricultural implements. Motion given by driving the wheels, by winding along a chain or rope, by rack railway, and by thrusting on crutches.

2nd. Locomotive engines working rotatory cultivators.

3rd. Rotatory cultivators to be driven by steam, mode of working not specified.

4th. Portable engines, used to wind up ropes.

5th. Portable engines, driving endless ropes, working windlasses.

6th. Portable engines, driving endless ropes, working rotatory cultivators.

As early as 1630, David Ramsey took out a patent for making the earth more fertile, &c. Mr. Ramsey seems to have had an idea that the fire-engine then known could be employed for cultivating the earth; there is no specification of this patent, and he, in common with many of his successors, imagined that any new power must be equally applicable to agriculture as to other purposes.

The next patent was by Mr. F. Moore, in 1767, nearly 140 years later. This patentee's idea assumed a more definite shape on the subject, and, as far as can be judged from his specification, he imagined that steam-power could be applied to agriculture by a carriage travelling over the land, driven by steam, and used for traction. So confident were the patentee and his friends of his success, that they sold all their horses to avoid loss by their reduction in value.

Then follow Edgworth, 1770; James Watt, 1784, who appears only to have specified to prevent piracy, as he considered the boilers were unfit to bear the requisite pressure of steam; Pratt, 1810; Blenkinsop, 1811; Chapman, 1812; Reynolds, 1816; Barry, 1821; Cayley, 1825; Easton, 1825; Clive, 1830. Up to this date the only ideas of applying steam to agriculture that I can find any record of, with the exception of Major Pratt's. were to travel the locomotives over the land, and draw any given implement in their wake. This was proposed to be accomplished in a variety of ways. But in 1832 two patents were taken out by Heathcote and Saxton, the former for traction by a direct pull on a rope from a stationary engine, and the latter by driving an endless rope, and with this rope giving motion to a windlass, to which the implements were to be attached. Heathcote's patent was, I believe, carried out by Mr. Parkes. After this date, various schemes follow similar to those before mentioned, interspersed with schemes for giving motion to agricultural implements by hydrogen gas, by compressed air, by electricity, and even by a portable windmill. In 1836, Vaux, (followed by Hall in 1842, and Bonser in 1846) took out patents for revolving cultivators or harrows, though not specifying the way in which they were to be driven by steam-power, and this is the first record in the Patent Office of any such implement, though I believe the Norwegian harrow must have been known before that date.

Following these, we have an endless variety of modifications of the previous plans, presenting no marked novelty, but interspersed with some improvements in details, which rendered them more practical—as Claussen's, in 1846, for an arrangement of pulleys for conveying power to a long distance by an endless rope, for agricultural and other purposes (though agricultural purposes seem to have been second in importance to the propulsion of boats). Osborne, also, for two engines travelling along each headland winding-up-chain or rope, as carried out by Lord Willoughby D'Eresby. In 1847, appears the first plan for a locomotive engine-working rotatory cultivator, which Usher and "Talpa" have since rendered so familiar to us, and for which an endless variety of patents have since been taken out, interspersed with engines working hoes, spades, &c., but which, I fear, will exhaust strength and ingenuity that might be more profitably applied in a more practical direction.

The six classes previously named include all the schemes of which we find any record in the Patent Office, and I have been unable to obtain any other information, though I have no doubt many plans and schemes may be found scattered through the periodicals of the last fifty years, but as far as any practical purpose is concerned, this is, I think, all that we can require to elucidate the subject.

The present position of steam cultivation may be considered as having been fully represented at the Carlisle meeting of the Royal Agricultural Society in July last, by the machines exhibited there in competition for the Society's prize, and by the plans so spiritedly carried out by Lord Willoughby D'Eresby and Mr. Mechi. Four out of the six classes were represented at Carlisle:—No. 1. By Mr. Boydell's steam horse, that attracted so much attention from its elephantine movements, and which, though, I believe, useless as a mere means of traction for agricultural implements, yet may in time help us materially to a solution of the difficulty involved in performing the cartage of a farm; No. 2. By Usher's, for though many of the schemes for locomotive engine-working rotatory cultivators vary considerably in detail, yet they all agree in the main principle of a rotatory barrel, driven by the engine, to which, of course, different kinds of forks, spades, &c., varying with the nature and condition of the soil, may be attached. I do not think attaching ploughs to the barrel, as in Usher's, is likely to be the best mode of using the power.

No. 4 may be considered to have been represented by the Draining Plough, for though draining is a much heavier and more difficult operation than ploughing, and more power being required in one spot, may be thought better adapted to steam power than the ordinary field operations, yet a trial that has taken place during the last two months has proved its much more easy adaptability to the lighter work.

Class No. 5 was well represented by the Messrs. Fiskens' plan, which for light field operations was the only machine that approached a practical result.

Class No. 4 can hardly be said to belong to steam cultivation, as the mode of applying steam to them was yet to be devised.

Class No. 6 was not represented at Carlisle at all, and is only an idea (I believe a very valuable one) thrown out by Mr. Atkins, of Oxford; and, though provisionally protected, was not specified, but allowed to drop, and is, therefore, now open to the public.

I shall now beg to call your attention to that branch of our subject relating to field operations; and, as the locomotive solely used for traction belongs more properly to the carting of a farm, shall dismiss that for the present.

There are various schemes patented in the last few years for rotatory cultivators, worked by locomotive engines, all varying only in detail; and it has been the favourite subject of many of our agricultural writers; but I believe a little consideration would have spared them all much pains and expense, as, if there is one point more difficult than another from which to approach our subject, it is in this direction. The enormous weight of engines required in which an ordinary farm pressure of steam is used, and the weight necessary to give sufficient strength to the drums and frames; the difficulty of steering such a great load to the nicety required for field operations; the yet unknown difficulties that may meet the rotatory cultivator, though, at first sight, I confess it appears well adapted to the work, to say nothing of the power wasted in moving such a weight over arable land, and up ever so slight an incline, might well deter the most sanguine from any attempt of this kind; but it seems, from the Records of the Patent Office, such a monomania at the present moment, that I do not think it will be waste of time to endeavour to direct the energies of my brother inventors to a different channel. Were I to undertake to make one of these engines, I should first endeavour to make a simple engine, to be used for the cartage of a farm, making it as light as possible, by the use of high-pressure steam, and rendering it perfectly manageable for carting manure, corn, harvesting, &c.; overcoming all the practical difficulties resulting from vibration, &c.; and, at the same time, I should test the value of the rotatory tillage, by driving a rotatory cultivator from a stationary engine, by the use of endless ropes, as proposed by Mr. Atkins, and exemplified by Messrs. Fisken, at Carlisle. Then, should the combination of the two appear desirable, which is very doubtful, it might be accomplished with some chance of success. At present it will only bring with it bitter disappointment and wasted energies.

Of course, with these views, I consider the drawing an agricultural implement by employing a locomotive for direct traction, a still more roundabout and ridiculous plan.

For field operations we have, then, but two plans that can be considered as coming into competition, both of which have, in common, the important consideration of proposing to use any ordinary portable farm engine; both propose to drag any given field implement that may be attached to them, such as a combination of ploughs, harrows, drills, &c., but they differ in the means by which they accomplish the end in this respect. The one draws the implement by the direct traction of a wire rope, and the other by conveying the power from the engine to a windlass by an endless rope, the windlass winding itself up and down the field by winding up and paying off from two drums a wire rope, anchored at each end, or winding along a wire rope, as may be found best. I must premise my remarks on the merits of these plans by saying that I am myself a patentee of one of them, and had I not thought mine the best, I should not have entered on the competition, and I must leave you to judge of their respective merits, after giving you the reasons that led me to that preference. We will first consider the plan of travelling the windlass up and down the field. A small hemp rope is passed round the fly-wheel of a portable engine, placed in one corner of the field, one end being carried round a pulley at the opposite end of the same headland, and again round a pulley at the top of the furrow to be ploughed. It is then taken to the bottom of the field round another pulley at the bottom end of the same furrow, and again brought up the field to the top of the furrow, where passing round another pulley, it is attached to the other end of the rope, passing round the fly-wheel. In its passage up or down the field, it conveys power to a windlass by its friction on a pulley or series of pulleys mounted upon it, and, being set in motion, turns one or two drums mounted on the windlass, and either winds up or pays off two wire ropes, or winds up and pays off a single rope, winding along that rope by friction. The rope that conveys the power is supported at intervals by carriages, and, in order to convey the necessary power, must be made of hemp, and from its great length and the difficulty of supporting it, requires to be very small. As lightness is necessary, speed is also a requisite. It will have to travel at least one-third of a mile per minute to convey seven horse-power to the windlass, but, circumstances being favourable, almost the whole of the power is conveyed to the windlass, the loss by friction being very slight indeed. Any derangement of the pulleys, however, would, of course, at that high speed, consume any amount of power. The windlass, if made strong enough to wear well, with the drums and gear necessary to reduce the speed, cannot weigh less than 30 cwt., and the power required to draw that weight over the land cannot be less than one horse draft; assuming the friction of engine, pulleys, and windlass, at half horse-power, we have one-and-a-half horse-power consumed in keeping the machine in motion. Some experiments I have lately made on the friction of wire rope on the land, show that rather less than two horse-power is required to drive engine, windlass, and wire rope enough to work 20 acres of land (nearly a mile in length), the rope travelling at 2½ miles per hour, and being strong enough to pull up a ten horse engine at that speed. Thus we see that the advantage as respects friction is not greatly in favour of the former *plan*. The disadvantage of the windlass travelling up and down the field is very great, though the plough may be attached to either end of it, and ploughing may be thus easily performed, yet, if you wish to pull any other farm machine when you get to the headland, you have no means of getting the implement to the opposite side of the windlass and going back except by the assistance of horse-power, and this, as will be seen, does not apply to the simple rope, by which the implement can be easily turned. I think, with these disadvantages, the plan of traction by winding up a wire-rope is greatly preferable, as it is much simpler, having fewer wearing parts, is less liable to derangement, and more easily managed. The wear and tear on a hemp rope, at such a speed, and exposed to all sorts of weather, is a point on which I am not competent to form an opinion, but former experience would lead to considerable doubt on this point. Before proceeding to describe the two plans for traction, to which I shall call your attention, it will be well to consider what have been the causes of failure in the previous attempts of Heathcote, in 1837, followed by Osborne and Lord Willoughby D'Eresby. In the experiments that Mr. Parkes, the well-known draining engineer, tried for Mr. Heathcote, the difficulty experienced was, to procure any material that would convey the requisite power without entailing too much weight and consequent friction on the land, and I understand that the material he found best adapted to the purpose, were steel-bands rivetted together at the ends. Lord Willoughby D'Eresby, in the use of chain for that purpose, effectually prevented the possibility of success in his efforts, as the friction of chain on the ground is so great that it would consume almost more power than it is capable of bearing, when of any great length. The present perfection to which the manufacture of wire-rope has attained, has, however, entirely overcome the difficulties that beset *them*; and in Mr. Williams's and my own plan, wire-rope is the only material with which we propose working. Mr. Williams proposes to mount an ordinary portable engine on a frame, on one end of which two barrels are fixed, turned by the engine, by one of which a wire rope is wound up, and passed off by the other; one end of this wire rope passes straight down the field, and the other passing along the frame at right angles to the drum for some distance, and then down the field again, running along the frame anchored at the bottom, and meeting the other rope. The implement to be drawn is fixed between the ropes, and alternately pulled backwards and forwards by these ropes, the two frames being moved along the headlands as the work progresses. My own plan is to mount two drums on a frame, fixing them in one corner of the field, the portable engine being set so as to drive them with a short rope or chain working in pulleys. The ropes are led off the drums to opposite corners of the field, and there passed round pulleys, anchored on a chain stretched between two posts or anchors, and the drums, being alternately set in motion, wind the wire rope backwards and forwards between the two pulleys, which are moved up the field by being allowed to slip along a chain stretched between two posts or anchors as the work progresses, the engine and windlass remaining stationary until the whole field is completed.

My reason for preferring this plan is that I consider the number of pulleys in Mr. Williams's unnecessary, and injurious to the rope, as well as consuming power, and the fixing the windlass and engine on one frame, and moving them along the headland is unnecessary, expensive for first cost, and extremely cumbrous. To these remarks I may be allowed to add that one of my windlasses has been at work for the last six weeks at Mr. Smith's, of Woolston, near Fenny Stratford, who will be able to give you the results of his experience. I believe either of the above three plans is capable of solving the problem of the application of steam to field operations, and Mr. Smith's experience would fully justify me in saying that it may be done at a saving of 40 per cent. over horse labour. Mr. Smith's calculations are as follows:—4 men and boy will plough an acre in 2½ hours, or 4 acres a day. Thus only the same number of men are required as for horse labour, consequently, we have all the horse labour saved, which, deducting the cost of 7cwt. of coal, gives a saving of nearly half, as the wear and tear will hardly exceed the wear and tear of eight horses. Another advantage he considers must not be lost sight of, is that the land is not injured by the treading of the horses in wet weather, and, consequently, he can work it when he otherwise should be at a stand-still.

Having thus, I think, arrived at the conclusion that any given implement may be drawn over the land by an ordinary portable engine, it will be necessary to consider what implements are likely to be best adapted to be used with this tackle, so as practically to make it most serviceable. Ploughing, of course, is the ordinary operation of a farm, and a series of four or five ploughs, fixed in a frame, will at any rate best meet the present wants and prejudices of the farmer. Mr. Williams has invented a series of ploughs that have very considerable merit, and I have no doubt that but little difficulty will be found in adapting ploughs to meet the requirements of the farmer. I think there is every probability that some other implement will, to a great extent, supersede the plough, and to this attention ought now to be turned. Mr. Smith is now, and has been for some years, moving with horse-power, a sort of grubber, instead of the plough, and with, I hear, the best results. But I must confess I see no way of effectually and thoroughly turning over the soil, which is often necessary, both to expose it to the air and bury the stubble and weeds, but by the use of the plough. Still this operation can hardly be necessary very often in a year, and I believe a machine may be made which will take the soil up on a platform to a certain height, then, passing it through revolving harrows, leave it at once in a perfect tilth, and which may be worked by traction. This would offer great advantages, as the soil is often, when broken up, in a fit state to pulverise, but, after the sun's rays have heated it for a few days, it is quite impossible to break it. The sets of implements that may be found best for different soils and circumstances to be worked by steam-power, will be numbered by hundreds; and it is impossible for me to estimate the changes to which the application of steam may give rise, nor will my limits permit me to dwell longer upon it. It is worthy of serious and careful attention, and, I think, deserves at once to be the subject of extended experiments.

I have now to notice the working of a revolving cultivator by an endless rope, and, should experience prove that a rope used in this way is sufficiently durable for the purpose, I should think most highly of this plan. If ever rotatory cultivation is to be brought to bear, I feel sure it will be in this way, and, with the former proviso, I have no doubt experiments in this direction may lead to practical results of great value. It is simple in working, the experiments need not be expensive, and they have a fair prospect of success.

Having thus drawn your attention to what appear to me to be all the most practicable schemes and experiments for performing field operations by steam, I now have to refer to the other branch of our subject, the cartage of material to and fro on a farm. A large team of horses will still be required on a farm to do the necessary carting, going to market, &c., but during harvest every available horse is often required, especially on large light land farms. Can our windlasses be made available for harvest work; if so, the number of horses might safely be reduced two-thirds. The practice of ricking in the field is now common, and where this is the case, there can be no difficulty in using the windlass to bring the corn to one spot. You might fix the windlass in the morning and clear a 20 acre field with it in a short time. It can be removed and fixed again with ease in two hours. The windlass could be also used for carting turnips, but if a traction locomotive could be made available, it would be far better suited to the work. A tramway down the centre of the farm, using the windlasses to the right and left to bring material to the tram, would reduce the horse work to a minimum, but whether the locomotive could not be made to do the carting work of a farm is well worthy of attention. I am assured by Mr. Worby, who made experiments some thirty years back on the subject, that it is perfectly practicable. He has had forty years' experience in the various farm implements with which we are acquainted, as manager for Messrs. Ransome, and may be assumed to know what practical difficulties are likely to lie in the way. The great difficulty met with by Hancock, and others, on common roads, was the speed at which they travelled, but for this purpose three miles an hour will be a sufficient speed. I believe that a few experiments would lead to a successful solution of this problem. One essential to its success is, however, the use of very high pressure steam, so as greatly to reduce the weight of the engine, and consume as little water as possible. This has been pretty much reduced to practice lately at a mill at Navestock, belonging to Mr. Hall, and in a portable engine which he is using, in both which engines steam of nearly 300 lbs. pressure is used. These machines were made by his son-in-law, Mr. Charlton, and have been in work during two years. One difficulty that has beset this subject, the impossibility of driving two wheels, is now overcome by a very simple contrivance, which I am not at liberty to describe to you, and this is a great step in the right direction. Boydell's wheels, also, may form an important auxiliary in certain states of the weather, though I think they would hardly do in constant wear. Were I to attempt the solution of this question, I should use wheels to which Boydell's rail could be attached whenever the state of the weather demanded. Thus there are three directions in which, in my judgment, it would be well to make some experiments; 1st, in implements adapted to be worked with the steam windlasses; 2nd, in a rotatory cultivator, worked by a portable engine, with endless band; 3rd, in a locomotive used for traction to do the cartage of a farm.

I feel confident that a few well-directed experiments, in either or all of these directions, would bring out good practical results in the course of a few years: but I would ask you whether it is right that the carrying out of these experiments should be left to chance, whether, when so important a matter is involved as the rapid development of steam cultivation, it would not be wise to enlist the public in the endeavour to bring them to some practical solution. If left in private hands it may, and probably will, take many years to arrive at any real results, and at the cost of loss and disappointment to many of a deserving but unfortunate class of men, whereas I feel confident that with public assistance, a short time would enable us to solve both the three questions that at present seem most to claim attention, and others that no doubt would arise in the course of prosecuting these inquiries.

APPENDIX.

An Abbreviation of Patents, from the Records of Her Majesty's Patent Office, from 1630 up to the Present Time.

No. 50. Date, 1630.

David Ramsey, Patentee—Short title, "Making the earth more fertile." Object of the patent—to raise water from low pits (as coal-mines) by fire; to make barges go against wind and tide; and to make the earth more fertile. No specification of this patent being enrolled, we are left to guess the mechanism at issue. At this period, steam-engines were termed "fire-engines," and Mr. Ramsey's ideas appear to have been to communicate rotary motion to carriage wheels, and, by such means, propel the carriage and engine forward, dragging after it ploughs and other cultivating implements of the period.

Nos. 921 and 933. Dates, 1767 and 1769.

Francis Moore, Patentee.—"Fire-engine to supplant horses, &c." No specification of either of these patents is enrolled, the only information we can give being the following, abridged from the *Mechanics' Magazine*, vol. 16, page 135. A correspondent writes that Mr. Moore's new invented machine, to go without horses, for which he has obtained a patent, is not only adapted for wheel carriages in general, such as coaches, chaises, waggons, &c., but to ploughing, harrowing, and every other branch of husbandry. Also to all other machines and engines now in use in the kingdom in various branches of manufactures where horses are required. The patentee and his friends were so confident that horses were doomed, and about to be superseded by steam as a motive power, that they sold their teams in order to avoid loss, convinced that they (horses) would soon be reduced to one-fourth their value.

No. 953. Date, 1770.

Richard Lovell Edgeworth, Patentee.—"Endless Railway." No plans were given with the specification of this invention, and the inventor rather leaves us to guess at mechanical details. We are informed, however, that the railway consists of planks of wood on the periphery of cart or waggon wheels. That the wheel, in rolling to the extremity of one plank, lays down another in front, while it lifts a third behind—that the rails or planks on the opposite sides of the wheel would thus balance each other so as to reduce the additional draught on the horses to a minimum; and that the advantages on rough roads and soft ground would be incalculable, not only to the agricultural interest, but all who used carts and horses. The specification is only to be seen in the Roll's Chapel.

No. 1,432. Date, 1784.

James Watt, Patentee.—"Steam Carriage." In his specifications, Mr. Watt states "the propulsion of land carriages"—a specification sufficiently comprehensive to include agricultural implements, as ploughs, sowing-machines, harrows, &c. The patentee, however, never built a steam carriage, for reasons which he himself thus states:—"I soon relinquished the idea of constructing an engine on this principle (high steam), from being sensible it would be liable to some of the objections against Savry's engine, viz., the danger of bursting the boiler (constructed of wooden staves), and also that a great part of the power of the steam would be lost, because no vacuum was formed to assist the descent of the piston."—*Watt's Narrative.* For the purpose of ploughing, the engine would have drawn the ploughs behind it, on the traction principle, as exhibited at Carlisle by Mr. Boydell.

No. 3,309. Date, 1810.

Patentee, Major Pratt.—This is an extensive project, and, from the specification being only to be seen in the Roll's Office, it appears to have escaped general notice. Cultivation of land is performed in several ways. 1. A series of ploughs revolve on a horizontal axis, the ploughs being raised over the ploughed land. 2. Harrows are worked in a similar manner. 3. Land is cultivated by means of chains, having tines or grubbers fixed in them, working longitudinally over two vertical pulleys, one at each end of the machine; and 4, by means of an endless chain passing over horizontal pulleys or carriages placed along the field, one pulley being on each carriage. To one side of the endless chain a plough is attached, and works alternately between two carriages, the carriages being moved forward as the work proceeds. Thus, a carriage on four wheels, one at each end or side of the field, and a locomotive or portable engine in the centre, with endless chain and two ploughs, would form the details of the project for ploughing a field of land.

No. 3,431. Date, 1811.

John Blenkinsop, Patentee.—"Certain mechanical means, by which the conveyance of coals, minerals, and other articles is facilitated, and the expense attending the same rendered less than heretofore." The specification of this patent informs us that it consists of the application of a rack or toothed rail laid down on one side of the roading from end to end. Into this rack a toothed wheel is worked by the steam-engine, the revolution of which wheel produces the necessary motion, without being liable to slip in descending a steep inclined plane." Mr. Blenkinsop, in reply to queries put to him by Sir John Sinclair, stated that his "patent locomotive engine, with two eight-inch cylinders, weighs five tons, consumes two-thirds of a hundred-weight of coals and fifty gallons of water per hour; draws twenty-seven waggons, weighing 94 tons, on a dead level, at three and a-half miles per hour, or 15 tons up an ascent of 2 inches in the yard; when lightly loaded, it travels ten miles per hour, does the work of sixteen horses, and costs £400.—*Engineers' and Mechanics' Encyclopædia.* For field purposes a portable rack railway was proposed.

No. 3,632. Date, 1812.

Patentees.—The Messrs. William Chapman, Durham, and E. W. Chapman, of Wallsend, Northumberland. A "Steam carriage with a rigger working on a stretched chain or rope, secured at both ends by anchors." It was worked for some time on a railway, but was obliged to be given up, it is said, owing to "the waste of power arising from the excessive friction of the chain or rope." Several propositions have been enumerated of rigger traction for actuating ploughs, &c., in the field, on the principle adopted in this patent.

No. 3,973. Date, 1816.

Joseph Rynolds, Patentee.—"Steam carriage for ploughing, carting, rolling, drilling, threshing, &c.," the former being on the traction principle. There are some good points about this machine deserving of notice, such as the reverse action of the wheels—enabling the carriage to turn on an *area of its own length.* The broad roller wheels, again, to prevent them sinking in the soil, have since been adopted by several patentees. It is only to be seen in the Rolls Chapel.

No. 4,575. Date, 1821.

John Richard Barry, Patentee.—"Endless railways." The principle carried out in this project is that of a heavy body moving on rollers. A series of wheels and axles working in plummer blocks fixed in two endless chains, one at each side of the carriage frame, pass over four chain pulleys, two on each side. Each axle has four wheels, two at each side, the one being less than the other. The largest two act as wheels for supporting the carriage on the ground; and the smaller two for rollers under the frame of the carriage. When the ground wheels come to an obstacle, they remain stationary, the carriage rolling over the other two; setting down two wheels in front of the carriage over the front two chain pulleys, and taking up two wheels behind for each of the two purposes involved; the ground wheels, and roller wheels, the axles, wheels, and chains in which they work passing over the chain pulleys.

No. 5,260. Date, 1825.

Sir George Cayley, of Brompton, Yorkshire, Patentee. —"Endless railway." This project is nearly the same in principle as Mr. Barry's above, but differs considerably in mechanical details. It has less merit, indeed is hardly worthy of further notice.

No. 5,267. Date, 1825.

Josiah Easton, Patentee.—"A rack and pinion railway." This is a similar project to that of Mr. Blenkinsop's, already noticed, the difference being, that Mr. Easton places the rail in the centre of the roadway, whereas his predecessor had it at one side. The advantage of this is the obviating the strain experienced in Mr. Blinkensop's case from the rack being at one side only.

No. 5,950. Date, 1830.

John Henry Cline, Chelt-house, Staffordshire, Patentee.—"Certain improvements in the construction of, and machinery for, locomotive ploughs, harrows, and other machines and carriages." The improvements here consist principally (1) in the enlargement of the carriage wheels for supporting the engine, (2) attachment of a crank pin to one of the spokes, with a greater crank radius than ordinary, and (3) in using a broad roller wheel under the centre of the carriage, for driving and steering.

No. 6,172. Date, 1831.

Miles Berry, Patentee.—The improvements contemplated by this invention have principally reference to engines and boilers of stationary or portable engines for agricultural purposes.

No. 6,267. Date, 1832.

John Heathcoat, Tiverton, Devon, Patentee.—"Certain new or improved methods of draining and cultivating land; and new or improved machinery and apparatus applicable thereto; which machinery and apparatus may be applied to divers other useful purposes." This machine is principally for cultivating soft mossy lands. It consists of a broad endless strap or floor, passing over two large pulleys, one at each end of the steam carriage, and four intermediate small pulleys, each pulley consisting of three discs or wheels the endless floor forming a railway, and the pulleys the wheels of the carriage, six on each side. Between the two endless railways, the boiler and engine are placed. For ploughing, one end of a drag rope is fixed on to a long drum, situate longitudinally over the boiler, and in length equal to the length of the field coiled upon it. The rope then passes to the opposite headland round a large pulley there of an auxiliary carriage, which serves for an anchor. The rope then returns, and is fixed to the opposite end of the long drum. To one side of this rope the plough carriage is fixed. The drum is then set in motion, when it coils up the one end of the rope as it gives off the other, the engine-carriage and auxiliary-carriage moving along opposite headlands as the work of ploughing advances.

No. 6,531. Date, 1832.

Joseph Saxton, London, Patentee.—"Differential pulleys." This is a rigger motion and traction machine. The parts claiming notice consist of two riggers or pulleys of different diameters on one axle, situated vertically in the centre of front part of the carriage or locomotive. An endless rope passing over two anchored pulleys takes a turn, the one side round the larger pulley of the carriage, and the other side round the lesser one. To gain a high velocity, motion is communicated to the small rigger, and *vice versa*, to the large; this, however, is only one way out of several proposed of putting the rope or ropes on the riggers,—a second plan was, to have a single rope taking one turn round the rigger of the carriage, the two ends being alternately wound upon two anchored drums at opposite head-lands,—and a third plan was to have a single traction rope, as in the case of Chapman's patent, and an endless or single rope for driving, the traction rope taking a turn round the small rigger of the carriage; for slow motion, the driving rope working on the other, and the reverse for quick motion. Several very ingenious plans were adopted to obviate the cutting action of the ropes where they pass each other on the riggers, as, a slight divergence from a right angle with the axis, pulley guides, &c. The project was reduced to practice, and tried on a piece of railway near Regent's-park, but did not answer. The principle of mechanism involved, as applicable to agricultural purposes, is that of a travelling windlass, and gave rise to numerous suggestions of improvements at the time, as the cart wheel, subsequently noticed.

No. 7,118. Date, 1836.

Thos. Vaux, Land-surveyor, Essex, Patentee.—"A revolving harrow." Strictly speaking, this machine has no connexion with steam, but as it has on several occasions been quoted in opposition to patents for rotary steam cultivators, as Hoskyns's, and may be wrought by that power, we give it. The same patentee holds patents Nos. 7,446, 7,624, and 7,905, all in connexion with the culture and fertilisation of land.

No. 7,458. Date 1837.

John Upton, Engineer, Surrey, Patentee.—"Steam boilers applicable to agricultural purposes," or "an improved method or methods of generating steam-power, and applying the same to ploughing, harrowing, and other agricultural purposes, which method or methods is or are also applicable to other purposes, to which the power of steam is or may be applied." Mr. Upton's engines are on the rotary principle. There are two of them—one on each side—on the shafts of which are two small pinions—one on each. These gear in the top of two spur wheel on the axle of the running wheels of the carriage, similar in principle to what has been adopted by Mr. Boydell. The specification of this patent has been printed, and to it we refer for details.

No. 7,547. Date, 1838.

Ambroise Ador, of Leicester-square, London, Patentee.—Improvements in obtaining motive power for various purposes, including the propelling of land carriages by means of ignited hydrogen gas in chambers at the extremity of revolving arms, on a common spindle, something on the principle of Barker's mill. If this gas is poured into a chamber by means of a valve in the centre of the arm, this valve closed, another opened at the side, and the gas at this vent ignited, the recoil action will force round the arm of the mill, and thus communicate motion to machinery.

No. 8,207. Date, 1839.

Henry Pinkus, of the Old Slaughter Coffee House, St. Martin's-lane, Patentee.—A stationary engine forces compressed air or gas through main pipes in the ground, supplying the engine of a locomotive ploughing apparatus, &c., by means of vertical pipes at certain distances, and an elastic tube communicating between the two. As the locomotive advances, this elastic tubing is unwound from a drum, and in returning is wound upon the same. The inventor assumes that an estate of 16 miles might be laid down with main pipes, and cultivated with one engine in a central position.

No. 8,329. Date, 1839.

Alexander McRae, of British Guiana, took out a patent for steam culture by means of a portable engine, endless rope, the necessary anchorage, and two series of ploughs in a carriage or frame on wheels, one for ploughing up land and the other down. The invention was principally intended for the low level lands of Guiana, intersected at short distances with a net-work of canals. Accordingly, the steam engine was placed in a punt or barge at one side of the field, and the anchor, so to speak, with its pulley in another at the opposite side, the two sailing up or down as the work of ploughing or harrowing progressed.

No. 8,331. Date, 1840.

John Lee Nicolas, Clifton, Bristol, Patentee.—"Certain improvements in the method of constructing and propelling carriages on common roads and through fields for agricultural purposes." Claims the method of propelling carriages or ploughs by means of crutches or legs, and working them by means of arms mounted on a shaft and actuated by motive-power. Vibrating levers are weighted at one end, the other having a joint with a pending lever or leg with a shoe. As the arms revolve, the shoes or feet of the legs press against the soil, forcing the carriage forward.

No. 8,644. Date, 1840.

Henry Pinkus, St. Martin's-lane, Patentee.—"Improvements in the methods of applying motive-power to railway carriages, canal boats, and agricultural machines." As to the latter, in a given area of land a central station is erected, in which is here placed an electric battery or batteries, having wells and tanks placed in the same. From the station main pipes are laid down, having at intervals of 200 yards or so, short, vertical, supply branches, terminating in a box with a moveable lid. In the main pipes wires are laid connected with the positive and negative poles of the battery, thus constituting electric circuits. In the locomotive engine an electric magnetic engine is applied, and in order to set the former in motion, chemical action is induced in the batteries at the station tanks, and electrical influence being thus generated, the force of which acting through the metallic circuit, the wires passing round a small drum will put the impelling engine in motion.

No. 9,402. Date, 1842.

Joseph Hall, Cambridge.—"Certain improvements in machinery for tilling land." This is a rotary cultivator, and, like Mr. Vaux's, is not a steam one. It involves principles, however, to which reference has also been made in taking out patents for rotary steam cultivators, and therefore we quote it. In it the rotary "delving machine" moves at right angles, or an angle from the line of progression of the carriage, so that the velocity of the latter does not interfere with that of the former, beyond giving it a diagonal direction, *i.e.*, if the diggers rotate at right angles from the line of progression, the spit or furrow which they cut will be in a diagonal direction from it.

No. 10,135. Date, 1844.

Wm. Stace, of Berwick, Farmer, and **Philip Vallance**.—"Improvements in applying power for draining or working ploughs, and other instruments used for agricultural purposes." This is no less than a locomotive windmill for ploughing land, &c. Two long poles are anchored, one at each end of the field; to each of these two pulleys are fixed. At the opposite ends of the two poles a frame is anchored, containing three more pulleys. An endless rope passes over the whole of these, a double rope stretching along the field. On each rope a plough is fixed, the ploughs being at opposite ends, worked by two ploughmen. A portable windmill sets the whole in motion, and the ploughmen can stop their ploughs at pleasure without stopping the windmill.

No. 10,578. Date, 1845.

John Baptiste Simson Teissier, Engineer, and **Antoine Hippolyte Triat**, Professor of Gymnastics, Paris, Patentees.—"Propelling vessels, carriages, and agricultural machines." The specification of this patent is printed, and to it we refer for details. The method of propulsion is by crutches (or propellers, as the patentees term them). A series of these operating by a crank shaft below the engine, forces the carriage forward as the cranks revolve by catching hold of the ground. The drawing represents a series of spade-shaped cultivators, following in a second tire across the path of the carriage, forcing themselves into the ground by their own weight, and tearing up the soil on the principle of action exemplified by the old Roman plough.

No. 11,297. Date, 1846.

Thomas Bonser, of Merton, Surrey; and **Wm. Pettitt**, Lambeth, Patentees.—"Certain improvements in machinery for tilling land." This has been termed a "screw plough." "It consists of a shaft or drum with radial cutters, or prongs, or tines, either straight or curved, attached thereto and arranged around it spiralwise, and is proposed to be actuated either by horse or steam-power.

No. 11,303. Date, 1846.

Peter Claussen, of Leicester-square, London, Patentee. —This is a large project, under the title of "Improvements in methods of—and apparatus for—propelling, and exhausting, and compressing air and aeriform bodies." The specification is printed, and comprises nine pages of letter-press and six large drawings, and to these we must refer for details. The method of working ploughs is by rigger traction, but the plan of tackling the riggers adopted by Mr. Claussen is different from that of his predecessors, Chapman and Saxton.

No. 11,304. Date, 1846.

John Tulloch Osborne, Esq., of Demerara, Patentee.—"System of steam ploughing." According to this plan, two portable engines are used, one for pulling the one way, and the other the opposite. Each engine has two drums, the one giving off rope to the opposite engine, and the other taking in rope. Portable railways, or tramways, are placed about 100 to 200 yards asunder, and on these the engines travel across the field, ploughing the land between them into ridges. Two plough-carriages, on wheels, are used, having one-way ploughs, one being drawn the one way, ploughing the one side of the ridge, while the other is being drawn the opposite way, ploughing the other side of the ridge, or the corresponding side of a second ridge, according as the ploughs are made, so that both engines are always kept in use. At the headlands, the ploughs are shifted from the one side to the other, as in ploughing with horses. Each plough-carriage, as it advances, lays down the return rope. In level land, intersected by rivers, canals, or ditches, provision is made for placing the locomotives one at each side of the field—so as to permit of the lands between them being ploughed.

No. 11,907. Date, 1847.

Sir **John Scott Lillie**, of Fulham, Patentee.—"Improvements in machinery for tillage, &c." The specification of this patent is printed, and we shall again refer to it for details. It is hardly possible to give in a few words an intelligible description of Sir John's project. The carriage has two set of wheels, one for running from headland to headland, and the other transverse ways across the field. The former have endless railways, consisting of jointed rails passing over skeleton rails, one at each end of the carriage for each endless chain of rails, passing under and over these wheels on each side. Either ploughs or rotary tillers are used, or both. A rope is stretched along the field, and anchored at each end by "grapnels" in the ditch. This rope takes a turn round a rigger, or "whelp wheel," on the locomotive; motion is given to this wheel by the engine, with the necessary intermediate gearing, when the whelp wheel winds its way along the rope, ploughing or digging, as the case may be, or both, at one operation. In cutting corn the machine moves sideways on the transverse wheels, cutting its own length as it proceeds. To effect this, two drums are placed, one at each end of the long carriage. Over these, endless straps or chains work, having scythes fixed at short intervals in them, and set at an angle for cutting. On motion being given to the drums, the chains and scythes revolve at a rapid pace, cutting the corn as they proceed. We cannot conclude by saying there is much appearance of successful practice in this project.

No. 11,977. Date 1847.

Pierre Philippe Celestin Barrat, of Paris, Patentee. —"Improvements in machinery for tilling and working land." This machine cultivates the ground with mattocks; the object of the invention, as he tells us, being to imitate the action of such a tool when worked by man. For this purpose, or to accomplish this, a frame is placed behind the engine, about three-feet from the ground. In this frame is a transverse shaft, in which are sockets for receiving the handles of the mattocks. This frame and shaft have a longitudinal reciprocating motion. The handles are raised by stud pins in rollers, and when up to their proper height, are relieved by means of springs, when they fall to the ground, and thus, by the three movements, progressive, transverse, and vertical, penetrate the soil and turn it over. The patentee claims, 1st. The arrangement of two rows of mattocks, to which, on the one hand, an alternate rotary movement is given; and on the other hand, a "to-and-fro movement," in such a manner as to imitate as much as possible the working of a mattock by the hand; 2nd. The mode of giving increased power to the instruments as they fall into or enter the ground; 3rd. The means for regulating the height of the frame and mattocks from the ground; 4th. The means of regulating the speed of the carriage when at work; 5th. The means of regulating the speed of the carriage when travelling from field to field; 6th. "Combining wheel," for changing the speed of working, and for stopping, &c.; and 7th, arrangement of machinery to securing an equilibrium, notwithstanding inequalities of soil.

No. 12,710. Date, 1849.

James Usher, Edinburgh, Patentee.—"Improvements in machinery for tilling land." This rotary steam-plough is too well-known to require description.

No. 12,860. Date, 1849.

George Galloway and **Robert Allee Purkis**, Patentees.—"Apparatus for ploughing land." This machine consists of a triangular frame, connected with a locomotive engine. At each angle of this frame are three chain pulleys on one shaft. Over these, three endless chains, carrying coulters or other tilling apparatus, work, so that with the progressive motion of the frame and transverse motion of the chains and tilling apparatus, a furrow is made diagonally, the one tiller following the other, so as to cultivate the whole of the land regularly.

No. 12,930. Date, 1850.

Henry Cowing, Blackfriars, London.—"Improvements in obtaining motive power, and in steam and other ploughs, in land carriages, in fire-engines, in raising water for draining and other agricultural purposes." No specification enrolled.

No. 13,159. Date, 1850.

Paul Rapsey Hodge, Adam-street, Adelphi, London, Patentee.—"Improvements in certain descriptions of steam engines, and in their apparatus and management for cultivating and manuring the soil, and treating the produce thereof. This is an improved steam digging machine for cultivating the land, and mixing the manure spread upon it. It consists of two series of spades, on two crankshafts, at the back part of the machine. The handles of the spades work in slide sockets, from which they are expelled by a spring for the purpose of throwing off the spit.

No. 13,168. Date 1850.

Weston Tuxford, Boston, Patentee.—"Improvements in machinery for crushing and pressing land, to be wrought either by horse or steam power."

No. 13,222. Date 1850.

George Thomson, Regent's-park, Patentee.—"Certain improvements in machinery and apparatus for cutting, digging, or turning up earth, applicable to agricultural purposes." A crank shaft digging machine, with apparatus for turning off the spadefulls of earth when lifted by the diggers. The machine may be actuated either by a stationary engine in any part of the field, or by one attached to it.

No. 13,564. Date 1851.

George Gutherie, Chamberlain to the Right Honourable the Earl of Stair, Wigton, Patentee.—"Improvements in machinery for digging, tilling, and working land." A forking machine. Claims—1, General arrangement of forks; 2, Mode of turning them by a screw travelling slide; 3, Use of guides for directing the forks; and 4, System of digging and turning the forks.

No. 13,757. Date, 1851.

David Stephen Brown, Old Kent-road, Surrey, Patentee.—"An improved agricultural implement." This machine is on the rotary principle, and consists of blades or cutters fixed on spindles, of which two are used, one in advance of the other—the front cutters being smaller than those behind. The bearings supporting the spindles have a vertical motion, on a joint, to permit of their being raised so as to take the blades out of the ground. The machine may be either wrought by horse or steam-power.

No. 13,943. Date, 1852.

Martyn John Roberts, Gerard's-cross, Bucks, Patentee.—"Improvements in Agricultural Implements." This is another machine on the rotary principle. A series of discs revolve on a shaft, carrying rocking bars towards their circumference, armed with tines or diggers. These bars, working by means of eccentrics on the axis of the discs and connecting rods, give to the tines a reciprocating motion, independent of the rotary, the object of which is to make them enter the ground in the easiest manner, and loosen the soil so as to make the best work. This mechanism is very complicated.

The following are under the new statute, and hence are printed. We shall merely give the number, date, name of patentee, and title, referring to the printed specifications for the rest.

No. 764. Date 1852.

Thomas Chrippes, Land Agent, Petworth, Sussex, Patentee.—"Tilling land."

No. 949. Date, 1852.

John Bethell, Westminster, Patentee.—"Apparatus for digging and cultivating land."

No. 965. Date, 1852.

Denis John Murphy, Cork.—"Machine for cutting, turning-up, and pulverising land."

No. 1,151. Date, 1853.

John Henry Johnson (pro Romaine, Canada).—"Machinery for effecting agricultural operations."

No. 1,899. Date, 1853.

Chandos Wren Hoskyns, Esq., Wraxhall, Warwick.—"Application of steam-power to cultivation of the soil by means of rotary tilling machines."

No. 2,147. Date, 1853.

Henry Jeanneret, M.D., London.—"Machinery for digging and tilling land."

No. 2,418. Date, 1853.

Alexis Dussuc, Brompton.—"Machine for digging and cultivating land."

No. 2,530. Date, 1853.

Joseph Bauer, Vienna.—"Machine for digging and harrowing by means of steam power."

No. 41. Date, 1854.

John Henry Johnson.—Machinery and rotary engines for effecting agricultural operations.

No. 260. Date, 1854.

Thos. Atkins, Civil Engineer, Oxford.—Apparatus for transmitting power to agricultural machines.

No. 431. Date, 1854.

James Boydell, Camden-town.—Endless railway.

No. 1,293. Date, 1854.

William Southall, London.—Machinery for breaking up or pulverising land.

No. 1,325. Date, 1854.

John Allen Williams, Wilts.—Machinery for ploughing and cultivating land.

No. 1,487. Date, 1854.

John Henry Johnson.—Agricultural machines, &c.

No. 1,626. Date, 1854.

Beaumont Cole, Hertford.—Agricultural machines.

No. 35. Date, 1855.

John Henry Johnson (pro Romaine, Canada).—Digging machines.

No. 288. Date, 1855.

George Tomlinson Bousfield, Brixton.—Steam-ploughs.

No. 1,030. Date, 1855.

John Allen Williams, Wilts.—Apparatus for applying steam power to agricultural machines.

Patents not Specified for 1855.

1,177. May 24.—Baron Von Gelgenhemb.
1,343. June 12.—A. W. Ford.
1,629. July 19.—Messrs. Fisken.
1,642. July 20.—John Henry Johnson, Patent Agent.
1,953. August 29.—J. Hanson.
2,224. October 5.—P. A. Halkett.
2,551. November 13.—F. A. Wilson.
2,766. December 7.—J. A. Williams.
2,848. December 17.—O. C. Evans.

It has been proposed to dig land on the principle of the steam-hammer. Suppose a series of oscillating cylinders constructed on the principle of the steam-hammer; but, instead of the hammer, a large fork, with a swivel action on the piston rod for turning off the spit. You will readily perceive that it would not take a vast amount of engineering to make the steam drive the forks into the ground; lift them out by one crank shaft motion; turn the fork by a second on its swivel; advance another step by intermittent progression, and so on. All this is plain sailing, at least on paper.

DISCUSSION.

The **Secretary** stated, that he had received several communications in reference to Mr. Fowler's paper, which, with the permission of the meeting, he would now proceed to read, taking them in alphabetical order:—

Mr. W. **Bridges Adams** says,—"As surely as steam-power has become the substitute for wind, water, and animals, in the processes of grinding, beating, pumping, lifting, and propelling, in mills, on farms, in mines, and on land, river, and sea, so surely will it be the means of performing like operations on farms, in ploughing, harrowing, and transport, and yet other things, till such time as a new motor shall be discovered, combining equal power with diminished weight of machine.

"In the application of steam to its yet desirable purposes, we should first define what those purposes are. The first is, to break up the ground to give access to air, and give, or get rid of, moisture. The second is, to impregnate the ground with the various chemical materials known under the general name of manure. The third is transport, to bring the mechanism and materials of produce on to the ground, and to carry the produce off the ground.

"In breaking up the ground, the mode of working must be determined by the quality of the ground. If homogeneous, as clay, or loam, rapid rotary action will be found the most desirable; if stony, and especially if the stones be of various sizes, the ploughing or grooving action will be the best. Whether the cutting of the ground be produced by a locomotive engine directly, or by a fixed engine through the agency of ropes, it is desirable that the engine should be as light as possible, and to possess lightness, together with great power, steam must be used of the utmost possible pressure. A small boiler is essential for lightness, and with a small boiler, fortunately, the strength of resistance increases. But after a certain point the radiation of heat becomes excessive, though the pressure remains the same, and for the sake of economy in fuel, the means of confining the heat must be very different from what we at present employ.

"If the locomotive engine be used for motive power, we must use rails; and then the question arises whether we are to use the portable rail laid in short lengths round the wheels, or portable rails of another class which we may call moveable, or rails laid down as a fixture. The wheel rail, or, as we may designate it, the ground-shoe, is not all advantage. It is an additional weight constantly moving about, and extra force is required to move that weight, and overcome the adhesion to the ground. Fixed rails would be too costly, and would involve the levelling of the ground in plateaux, and many other arrangements, and we may, therefore, dismiss them, and consider the subject of portable or moveable rails.

"Whether they are to be used for a locomotive engine or merely for wagons, must determine the question of position, strength, and the amount of bearing surface requisite to prevent their sinking into the ground. But in any case, the attachment of the rail bars to each other must be such as to constitute them a continuous bar of sufficient strength for the object, and without any surplus weight, and for this purpose they must be wholly of iron, and not involving the use of timber, increasing the bulk and weight. If the connexion of the bars be perfect, a much lighter rail will suffice, on the well-understood principle that a beam with fixed ends will bear one-half more load than one with the ends loose, the relative strengths being the same. A good form for the rail is a bar of ⊥ section, with the vertical rib above the flat base. A better form would be a cruciform section, giving greater vertical depth. A model is laid on the table, of a ⊥ rail of 28lbs. per yard, connected by a joint rendering it a continuous bar. The wheel to run on this rail should be a double-flanged sheeve, taking a vertical pressure, and not tending to thrust the rails out like an ordinary coned wheel. And the wheels should be arranged to revolve independently on their axle, while the axle also revolves in the ordinary bearings.

"If it be desired to run a locomotive on a light rail, it would be a very practicable thing to use Mr. Boydell's wheel shoes for slow rates of speed. In this mode, the bearing of the wheel being extended, the rail would not be damaged by the increased weight, and the adhesion would be increased so as to prevent slip on inclines. And the disadvantage of lifting masses of mud in wet weather would be avoided.

"With the rail-bars firmly and efficiently connected together, it would be very practicable, by means of Mr. Boydell's engine arrangement, to slew the rails laterally by applying force at the end, and thus changing the course of the line when required. Something similar to this is done in Wales for the purpose of delivering and stacking slate from the quarries.

"The mode of applying the force of the pistons to the peripheries of the wheels in order to make the portable farm engine locomotive is exceedingly useful. It is the converse of the plan of Mr. Whitworth for a street-sweeping machine, where the wheels, moved by the horse, give motion to the machinery instead of the machinery to the wheels, as in Mr. Boydell's engine.

"The shoes, as applied to the engine, appear clumsy, and are rather adapted to make the engine locomotive, with a view to its own transit, than for the purposes of haulage. But this is a most valuable application, and when applied on a light rail to enable it to do the work of a heavy one, the disadvantages are lessened, as compared with the ground surface, and especially if a ploughed field, where the poaching would be very like that of horses feet. Altogether this simple arrangement of Mr. Boydell is a great move in advance towards steam farming.

"Thus far we have a portable engine adapted for all the uses of machinery as a fixed motor, and also as a tool of transit; but this is not all the purposes it may be made to serve. There are purposes other and quite as important to which it has not yet been applied.

"The process of manuring land is tedious and costly. In the ordinary methods a large mass of material has to be carted on to the field, much of which goes into the atmosphere. In improved methods, chemistry reduces the bulk of the manure, and in modern practice dilution with water is superadded. But in all these cases a considerable bulk and weight has to be transported.

"It is mostly considered heretical to bring novel theories before an audience, and the more especially if they be untried. But there are some processes that would not exist at all unless they began as theories, and the only hope of their becoming practice is to promulgate them. It is in the hope that some one may be induced experimentally to solve the question, that the writer puts forth his problem.

"In the production of vegetation three conditions are essential. First, the chemical constituents of the plant. Secondly, moisture, to dissolve those ingredients. Thirdly, warmth, to assimilate them. Some of the constituents are gaseous in form, and are easily evaporated. It would, therefore, be desirable to dispose them as low as convenient under ground, in order that as they ascend they may encounter and be absorbed by the roots.

"We drain our land artificially, and the land thereby becomes warmer, and a more generous kind of vegetation grows on it. Manuring land without draining it would be of little use. But there are times when wetting or moistening the land is also required. The problem then is how to manure, water, and warm at the same time, and apply these three ingredients of gases, warmth, and moisture in contiguity to the roots of the plants in such a position below them that they may ascend.

"This is a practicable matter in several modes. Suppose a series of earthen pipes, analogous to the drain pipes, to be laid at a small distance above them. We may imagine them a continuous pipe in a serpentine form, with a large pipe at the entrance, and a large pipe at the exit. The entrance pipe we may suppose analogous to the fire-box of a locomotive boiler, the exit analogous to the smoke-box. The intermediate serpentine pipe would then represent the tubes. A steam boiler, which may be the boiler of our farm engine, is then connected by a pipe to the entrance of the underground system. In that boiler are placed the materials of carbon, ammonia, and other gases, all at high pressure. The valve being opened, the steam and gases will sink through the underground pipes and saturate the ground, depositing therein heat, moisture, and chemical material. At first the steam will condense near the entrance; as the ground warms it will go further, and so on till it reaches the extremity, and the heat and steam will ascend, carrying with them the gases, and neither heat nor gases can escape, save upwards, if the exit and entrance be stopped, and in their passage upwards the rootlets will absorb them.

"Probably smoke from a close furnace might thus be injected, being connected to the entrance pipe, and a blower for the purpose of exhaust, worked by the engine, being placed at the other end. Whether the dry gaseous heat, or smoke, or the moist gaseous steam would be the best, would be a subject for experiment. But if the process of manuring could be performed by gases, it is obvious that an enormous cost in transit of bulky and heavy manure would be avoided.

"One condition of health in human beings is said to be to keep the head cool and the feet warm. Bottom heat is a favourite heat of the gardeners; and the reduction of heat in the greenhouse and hothouse at times is an absolute condition of the health of plants therein. In truth, plants like to keep their feet warm and heads cool, as well as we do ourselves. If a warm steam pipe or flue pipe be any where underground near a grape vine, the roots will infallibly find their way to it, and cling round it affectionately.

"We want then to prove practically and experimentally what would be the results of the products of combustion, heat inclusive, of a ton of coals deposited underground, and to what extent of area it would be beneficially available in aid of production.

"That it would be of large benefit we have no reason to doubt. In Saxony, and elsewhere, the effects of burning coal-pits under ground are evident enough by the green grassy sward, which contrasts so beautifully with the surrounding country when—

"'The long dull wolds are ribbed with snow.'

"It would be a very delicious thing to keep our gardens green throughout the winter by this process, and with dry warm walks. But there is yet more than the gratification of the eyesight.

"Vegetables not required to ripen do not need much sun, as celery, which we use in the winter, though sun is most important in the ripening process. It might, therefore, be possible to grow vegetables for green use throughout the whole winter, upon the same principle that Indian corn or maize, which cannot find in England sufficient sun to ripen it, will yet serve as a very delicious green vegetable.

"It would add very materially to London comforts, if the sloping banks of railways looking south could be thus cropped for winter use. There is also another consideration. We break up the surface of the ground to let in air, moisture, and gases from above. It is just possible that the steam process may fissure the ground more advantageously from below, and thus the cost of digging and ploughing be saved in peculiar positions.

"It may be objected that quickening vegetation underground would the more expose it to be nipped by frost. Possibly, but possibly also vegetables could be acclimated to this, just as trees, animals, and human beings change their character. 'There are more things in heaven and earth than are dreamed of in our [existing] philosophy;' and it were well to find them out, or disprove them practically. Gaseous food might prove to be to plants what hot coffee or nourishing soup is to ourselves; and it would be a useful discovery to find that the engine power of Sydenham might be turned to account to keep the gardens green at the season when fountains are too chilly to be pleasant.

"In all processes for farm improvement it will be well to recollect that the essential element, the basis of every thing, is—coal—and for the transit of coal there is no cheap method but railways. Farming improvement, therefore, means the gradual introduction into farms and villages of a cheap class of railways and locomotive engines, worked economically at low speeds. And the same engines will ultimately draw trains, pump water, thrash corn, cut hay, plough the land, and inject it with its vital fluid—steam—as well as perform many more mechanical operations than are as yet marked out for it.

"These suggestions are given in the hope that those who have leisure and opportunity, and appliances, will, after they have done laughing at what doubtless will at first be considered as wild theories, try to prove or disprove them practically. I believe it will turn out they are all of them simply new forms of doing old things, doing by art what has hitherto been done by nature, and all capable of verification analogically. Stirring the earth has hitherto been a process all moulded on the anatomical structure of a horse; the horse being invented first, the plough followed. But in cotton, iron, and wood machinery, are to be found abundant processes applicable to the cutting and carving of earth for agricultural purposes. The imagination of the poet is not needed for this, but only the perception of the analytic discoverer.

"In September, 1845, the writer promulgated these ideas in an article in the *Westminster Review*, entitled 'Railway Improvement.' This is a second attempt to draw public attention to it."

Mr. R. GARRETT, of Leiston Works, Saxmundham, says—"I have tried portable engines to draw by wind ropes and drawing endless ropes for ploughing, and, as far as my experience has gone, the result has not been favourable. The friction of the length of rope which is necessary for field cultivation on lands not level, and its coming in contact with the surface, added to that of the loss consequent on the friction rollers, and other guide and winding pullies, absorbed in my experiments so much of the motive power as to leave the power given off by the engine, to be exerted upon the work done, so reduced as to render the advantage of steam over horse power of small moment as compared with the outlay. I also found some considerable difficulty in sufficiently simplifying the arrangement of such ropes, whether made of wire or hemp, for management by farm labourers, or for the ordinary shape of fields as now cultivated. I witnessed some experiments of Lord Willoughby d'Eresby's with much interest, some few years since, and was there equally disappointed, through the same cause, and I think the results of his lordship's valuable experiments would lead him to the same conclusion as myself, with regard to the loss of power by the rope over the surface of the land. If I mistake not, in the experiments I allude to, at Stratford, the power given off a 10-horse engine was barely able to draw two furrow ploughs, thus losing six out of ten horse power in a small field. I have seen some experiments in ploughing with Boydell's tractive engine, and the result was certainly more advantageous, and the machinery less difficult to adjust and manage, than with a rope over a portable engine stationed. On the occasion to which I allude there was no steam indicator on the boiler, but we were informed that the engine was only working up to 12-horse power, and it drew ploughs turning four good furrows, on land which, I was informed by disinterested farmers on the spot, would have required three good horses to turn each furrow as well as this engine performed the four at one time. As all new inventions require perseverance to perfect, I am of opinion that a great deal of good is to be got out of Boydell's engine for field cultivation, as well as for other means of traction.

I apprehend it does not lose so much power by its own locomotion, even upon soft and uneven ground, in large fields, as a rope does for such traction. I am aware of the immense advantages of steam over horse power in this country, and no one is more sanguine than myself of the practicability of the former for the cultivation of the land. It has been ascertained that the horses employed in agriculture, consume one-fifth of the whole produce of the land of this country; therefore, their displacement by steam is very desirable, and every effort should be encouraged tending in this direction. I am of opinion, that many of us may yet live to see it effectually carried out. The greatest difficulty is, that the number of patents taken out under the present patent laws, (good as they are) has a tendency to clog inventors. As an individual, or a single manufacturing firm, I do not contemplate such an undertaking. I should be pleased, indeed, to see it at once taken up in earnest by those who have more courage and means to carry it out to perfection. I will use no disguise or secrecy as to my ideas of the means to be pursued to the attainment of this object. I will only trouble you with a very brief outline of my ideas as to the difficulties we have to encounter, and the remedies I would suggest:—

"1st. The difficulty we have at present to contend with is, to apply our steam-power to our present means of turning the soil, either with a plough or any other effective tool; because we find that a plough is not adapted to a steam-engine any more than a spade is to a horse, and a rotary motion does not appear to me to be effectual at all times, or on all soils.

"2nd. That the weight of the engine to travel over the land is a difficulty as well as a disadvantage; and although it may be done by a rope, it must be admitted that the rope has its disadvantages.

"Let us, therefore turn our attention to the construction of a tool that will effect its work on all lands in seasonable weather, and capable of being adapted to the power of a steam-engine. This, I believe, may be done by constructing a number of spades that will turn the soil as near as possible like the hand-spade; then, place an engine upon these spades sufficient to work them, and, thus connected with its work, its weight instead of being a hindrance will be a decided advantage, and by such weight, in connexion with the ordinary action of the piston of the engine, the means of propelling and turning the soil will be more effectually obtained than with any horse-propelling implement. I do not think that it is difficult to give the action of the hand spade, through the motion of a common portable steam-engine. Its travelling wheels should be hung on crank axles, or by some contrivance to raise or lower the depth of cutting and of the spade, and to regulate the same. It should, however, only partially rest on its wheels when at work to regulate the depth of cutting, but entirely when required to raise its diggers out of the ground, or in travelling.

"If these brief remarks should lead any inventors to the prosecution of the object before us, my earnest desire is that they may go on and prosper."

Mr. Robert Roger says:—A few of the disadvantages of the fixed windlass system of tillage of land are as follows:—

"1st. The remoteness of the motive power and means of stopping, when any obstruction occurs to make this necessary, either in the course of working or at the headlands, and the great liability to serious breakage from the carelessness or ignorance of attendants, or the derangement of signals.

"2nd. The great amount of wear and tear on wire rope, from trailing on the ground, in addition to the friction from winding and unwinding on the drums.

"3rd. The liability to saw itself into the soil on hills, and to derange the working of implements by pulling straight across hollows, thus making it difficult to cultivate undulating surfaces.

"4th. Considerable delay must be necessary at each furrow or bout, from the stopping, reversing and again getting away with the engine.

"5th. A much greater strength of wire rope is necessary, from having the entire weight of itself to haul, the whole length of the field, in addition to the implements, thus requiring additional strength of windlass machinery and anchorage to meet this; in fact, in the plans proposed, I see no advantage whatever over that abandoned by the Marquis of Tweedale some years ago; I believe, principally, on account of the wear and tear of wire ropes. The friction of a wire rope working light, being no criterion for the friction when the drag of an implement is on it.

"6th. With the wire rope travelling as proposed by Messrs. Fowler and Williams, there is no provision for turning any implement about, so as to be hauled back in the opposite position,—I mean such implement as a grubber or scarifier;—neither is there any possible means of communicating a rotary motion to any other implement, should this, as I think highly probable, be found advantageous for summer tillage. The plough will long, I think, be found best for turning over the soils.

"I now beg leave to point out a few of the leading advantages of the Fisken's patent mode of tillage:—

"1st. The power required to overcome the resistance due to the driving cordage is extremely minute; I have seen a man set above a thousand yards, in addition to the engine, going with one hand, and with more apparent ease than he could move the engine in any other way. This Mr. Fowler admits, 'is very slight indeed.'

2nd. "The weight of the travelling windlass and ploughs combined, capable of turning two furrows at once ten inches deep, does not exceed sixteen cwt. Have Messrs. Fowler or Williams succeeded in making one to carry the ploughs with less weight?

"3rd. The complete control the attendant has over the windlass, so as instantly to stop or reverse its motion. This is of immense value in the case of roots of trees, stones, as well as at the headlands, or in hilly ground, where the plough may be out of sight of the engine man, thus avoiding any possibility of its being hauled to the sheaves at the headlands; as it might be where the motor is a distant power and under distant control.

"4th. The small liability to wear and tear of the wire rope; it being subject to no action but that of winding and unwinding from the drums, not even having to bear the strain of dragging itself about, it may be made so much lighter.

"5th. The facility of applying any rotary action or mode of operating that may be found advisable. Suppose, even for removing or raising large stones or tree roots, the whole power of the engine may be devoted to that purpose.

"6th. The simple, yet perfect mode of anchorage, enabling the attendant to apply the power of the engine to shift the anchor when not required for the tillage implement, at the same time giving a powerful windlass, available for placing any other implement, such as a drag or scarifier, behind the travelling windlass, thus obviating the necessity for horse or manual labour for that purpose.

"7th. The effective steering apparatus for placing the ploughs in position for new furrows, or turning the travelling windlass in front of any other implement.

"In conclusion, I am sorry my experiments have been so limited, from being entirely dependent upon others for a motive power. In a few days I shall have an engine completed, when I shall make a series of experiments with the dynamometer and pressure guage; if it is thought worth while, I shall be most happy to answer any queries on the subject you may think desirable; I may just state, in the mean time, that, with an inferior four-horse engine and two men, we have ploughed to an average depth of eight-inches at the rate of six acres in ten hours; this is, I think, fully equal to the work of twelve horses and six men, for an actual cost of from 15s. to 20s. per day."

Mr. J. A. WILLIAMS says, "having about four years ago purchased a portable steam-engine, threshing-machine, mill, and other machinery, it was not long before I was struck with the thought that it would be perfectly practicable to cultivate the soil by steam power, and that it would be done to great advantage, as the great reduction of speed from the engine to the ploughs would give a power for the draught of the latter, the cost of which, as compared with that of horses, would be an immense saving. From that time to the present I have given the subject all the time I could spare from my other occupations, and have at last succeeded in bringing out a machine, simple in its construction and practicable in its results.

"The first thing that I did was to consider the nature of the work to be performed, and the best and simplest mode of applying the power to execute the same. It was evident, that, taking the soil of the kingdom generally, a very large proportion of it (say three-fourths at least) was more or less undulating, and I was soon perfectly satisfied that this difficulty, together with the loss of power requisite to propel an engine as a locomotive, the adhesion of the soil from her weight, and the further power required for cultivation from this cause, completely settled the question as far as regarded the employment of a locomotive engine for the purpose.

"Considering the subject further, I felt convinced that we ought to make use of the ordinary farm engine, from 4 to 6-horse power, which was coming into such general use, so that when a farmer had got an engine and had not half sufficient work for her, by adding a ploughing machine to his stock of implements he could find full employment for her by cultivating his land. Again it would be advantageous to those who let out engines and threshing-machines to hire, if a machine could be constructed whereby he could find full employment by taking work by the piece of those farmers who had no engines of their own, at such times when two days' work are wanted to be done in one; and at all times, if it could be done at a price far below what the cost and maintenance of horses will allow their labour to be put at.

"Having condemned, in my own mind, the system of locomotion, I had to consider the best method by traction. Of the power possessed in an ordinary farm engine I had no doubt, but the difficulty seemed to be, the mode of applying the power, so as to draw the cultivating implement as evenly over the soil as a piece of ruled paper. I at last concluded that, as far as possible, the engine and machine should be stationary whilst doing as much of the work at one time as it could. There were two modes of doing this; the one to remain at one corner of the field until it was completed, the other (the one which I have adopted) by fixing the engine to the machine by a pair of shafts, similar to a horse in a waggon, and connecting to both a long table, punctured at every nine inches to admit the pin or shaft of a guide pulley and roller, so that each of the implements serves as a purchase for the strain necessary to propel the cultivators; and by these means I can plough the width of 40 feet without moving, when the engine will propel herself and the machine forward the required distance for continuing the work. In looking at the advantage and disadvantage of both these systems, the former seemed greatly in favour of the continued fixed engine, but considering that the field to be ploughed may be 20, 30, 50, or even more acres (for if we bring this system practically to bear, hedges and trees must come down, and pits must be filled in, to make way for us), the additional length of rope which would be required to traverse the headland, before it turned at right angles into its work, and the distance the work would be from the power (a great consideration when limited to a 6-horse engine), I decided in favour of the one to move along the headlands as required, but which was always close to its work. Again, I considered between the two systems, the friction or loss of power I should sustain by the number of pulleys requisite to work each. In the one I have chosen, I cannot (except when the line of draught is opposite the drum) do with less than two to each rope; one to turn the rope on to the table, the other a shifting guide pulley to direct the rope into the field, and which is simply and easily shifted, the number of furrows required, when the ploughs arrive at the end of the field. In the other, that of remaining at one end of the field until it was finished, I found I could, in drawing the implements towards the engine, do with only one pulley, and that one of much larger diameter; but with respect to the back draught, it could not be done without two, if not three; and, taking into consideration the cost of the additional length of rope required, the wear and tear of it, the loss of power to a certain extent, besides its weight to handle and transport, I decided for myself to keep close to the work. The system which I propose to adopt with respect to working a field, those who have seen my drawings for the patent, or the working model which I exhibited at the Farmers' Club House, in December last, will be fully acquainted with. To those who have not seen either, suffice it to say, that when drawing a cultivator, or any implement other than the plough, I propose to pull both ways, to and from the engine; to accomplish this, it is necessary to have some purchase on the opposite side, for which I have constructed a carriage on wheels, with one large pulley wheel fixed, and a moveable guide pulley, as at the engine; the frame is likewise punctured at every nine inches for the same purpose; a bell and signal, similar to a railway one, is attached to this frame and travels with it: this is its use—I was for a long time puzzled to know how the engineer was to ascertain when to shut off the steam on the arrival of the ploughs, &c., at the opposite end of the field, more especially if from the undulating position of the land the said headland should be out of sight; at last I thought of a bell and signal, which acts as follows:—on the conductor getting near the platform he leaves his charge; and rings the bell which is to call the attention of the engineer to the signal; the engineer then lays hold of the handle of the throttle valve, and looks to the signal, which is turned off from him, and as soon as the conductor gets his ploughs, &c., sufficiently close, he turns the signal, and the engineer shuts off the steam. I find that even at present, without much practice, I can stop within a yard of the place required.

"This system I shall invariably adopt when using a scarifier or cultivator of any description, but with the ploughs there is a difference, and until a perfect one-way plough can be obtained there must always be a hindrance at each lands-end of shifting the plough from the right-hand side of the land to the left. The next trial which I intend having will be on a totally different plan, but before I describe it it will be necessary for me to digress from this hauling subject and consider another connected with it, but still of a different nature.

"Amongst the thousand questions I have had put to me with respect to ploughing by steam, one was, 'What will you do when you come against a great stone.' My answer at first was, 'I must do as I can; either the stone must give way to the plough, or the plough must give way to the stone;' but it made me think whether an implement could not be constructed which would adapt itself to this difficulty, and I set about my object with the aid of the village carpenter and blacksmith. I took an old drill which I had, crooked the axle, and formed it into a square head. I then formed a rectangular frame, sufficiently long to carry three ploughs. I felt that to make them independent of each other it would be necessary that they should slip up and down vertical standards, and likewise they should move in a lever the same as a drill, that they might act for themselves when coming in contact with a stone. It struck me likewise that the machine must be self-acting, that it must *hold its own ploughs*. This I accomplished by placing vertical standards in the rear, which, working in a slot at the end of the beam, gives the ploughs a perfect independent vertical action, without allowing them to move to the right or the left. Suffice it to say, that after I had completed my implement, I found I had discovered *a perfectly new principle*, that amongst all our farm implements there was none of *a combined nature* that I had ever seen or heard of, *which was perfectly independent of the frame, or each other*, but were all more or less connected by a horizontal bar, and thus preventing their freedom. Those who saw the two implements which I exhibited at the Smithfield Show in December last, viz., the three-furrow plough and the cultivator, will probably remember the principle on which they were constructed, and I am pleased to remark that on trying the same three-furrow plough subsequent to the Show, in a field with two single ploughs, three horses in each of the single ones, and five only in the three-furrow one, and testing them with the dynamometer, that the draught on the three was considerably lighter, being upwards of one cwt., than three of the single ones, at the rate the two were drawing; and had there been six horses attached to the machine, they would not have drawn harder than the six drawing the two ploughs.

"Such are the implements with which I intend making my next trial, and I have four of them now nearly ready. I am going into the field without the back-hauling platform, with the engine and machine only. I shall have four 3-furrow ploughs, and draw two at a time, with the assistance of two horses if required, so that by employing four horses, two to each set of ploughs, I shall always have two plough frames, with the spare rope at the far end in readiness, that by throwing the drum just wound up out of gear, and the other in, to go on again without any loss of time or steam.

"At the time the engine begins drawing the plough at the far ends, the two horses next the machine are going back empty with the two ploughs which came up last, and drawing the next or its own rope out with it to be in readiness for the engine when the other traverse is completed. Thus I see no reason why any loss of time should occur, except whilst turning at the end and shifting the pulley (which is instantly done) to draw up the second plough frame, and to take out the rope for the next pull. Under this plan it might be said that it is not altogether steam ploughing, but that does not matter, as at present we have the horses, and the two working with the engine need not draw if not required, but where the power is limited, as I propose, for the sake of expense and weight, it is of consequence to employ all that power in the hauling alone, and it may be satisfactory to those farmers who still wish to stick by their horses, to see them still at work, and their own steam-engine (to use a common term in these parts) *pulling tag*. There will be another advantage in using horses. The sudden strains on the rope, when the power of the engine is exerted on the cultivators, can be taken off by the horses being made to exert themselves at the time the rope begins to strain tight; and again, they are ready without hindrance to turn the ploughs and take them back. With respect to the number of hands required in the field, as the ploughs require no holding, one man with each is sufficient. Whether they can drive the horses at the same time, remains to be seen and proved by practice, but I feel confident that it will, ere long, be completed as a system with despatch and economy."

Mr. Mechi said he had received a note from Mr. Usher, regretting his inability to attend, and stating that he was still continuing his experiments with the steam plough, and which were certainly not unsuccessful. The conclusion which he (Mr. Mechi) had come to was, that the moving of a heavy body over the land was a very desirable thing, but was not very likely to be accomplished by the method he had, in conjunction with Mr. Romaine, tried. However, they ought not to despair, for the horse was about the worst machine they could use in respect to cost. A horse weighed about 15 cwt., and 13 cwt. out of that had to be employed in propelling himself, 2 cwt. only, therefore, was profitably employed by the farmer, as shown by the dynamometer attached to the plough. He considered that some encouragement ought to be given to the inventors of steam cultivators, because from what he had seen he believed that however much agricultural locomotives were found fault with, they would not in the end be the cause of so much disappointment as was supposed by some persons. They were all perfectly agreed that a great deal of money might be advantageously spent for so desirable an end as cultivation by steam, especially when they considered that every horse consumed as much as eight human beings. If there were only a million of horses employed in agriculture, they consumed the food of eight millions of people. He ought to say that Mr. Atkins (the contributor of several drawings illustrative of the subject under discussion displayed in the room), in whom he had great faith as a mechanic of a superior order, exhibited the same drawings at his (Mr. Mechi's) annual gathering two years ago, though not under such favourable circumstances as the present. He quite agreed that if they could have steam applied to field cultivation, they must work at very high pressure. Allusion had been made to Mr. Collinson Hall; that gentleman knew a great deal about steam power, and was now working at the high pressure of 200 lbs. to the inch, and that favourably. He hoped we should not much longer see that extraordinary anomaly, that while locomotive engines are conveying us at express speed to all parts, at a pressure of 90 lbs. to 140 lbs. to the inch, the Royal Agricultural Society should tie down steam engines to a pressure of 45 lbs. to the inch. With regard to the form of the cultivator, the plough was not the best tool that could be employed for steam engines. In using Mr. Garrett's horse-hoe—ten or a dozen steel table knives with the handles bent up—a pair of horses could positively cut seven feet of ground to a considerable depth; whereas, with a plough, they could not plough more than nine inches. Mr. Romaine still continued his trials with his engine, and had got another patent. Notwithstanding the great difficulty in getting money advanced for experimental purposes, he hoped there would always be experimentalists, and that the benefits of those experiments would yet be fully experienced. The Society of Arts was doing an immense amount of good by raising the question then under discussion. The papers which had been read had suggested several new ideas, and in this great country, where everything was done by steam, he hoped they would soon see it brought to bear for the production of cheaper and more abundant food for the people.

Mr. Smith (who exhibited a model of a new plough for steam cultivation, just invented and patented by himself,) said, the model he produced was that of an implement with which he had been making experiments for the last month. He had worked it with a seven horse-power engine, constructed by Messrs. Ransome, and a windlass constructed by the same firm under the direction of Mr. Fowler. The engine was stationary. By planting the engine in the centre of a 40 acre field, he found that by running out sufficient rope to do one part of that, he required 15 lbs. of steam from the engine to put the rope in motion, without moving the instrument. The power was conveyed from the engine by an endless rope by means of a windlass, to which, by two pulleys, a backward and forward motion could be given. The rope was supported from the ground on rollers, and when drawing the plough was quite above the ground. The engine, when working at 45 lbs. pressure, indicated seven horse-power. Working at a pressure of 35 lbs., it would cut a piece of ground 30-inches wide and 7-inches deep. He did 23 acres with that implement during the last month, and found that he could do 10 acres to the right and 10 to the left with only one shift of the tackle; and 40 acres could be done with only one move of the engine. The plough could be varied; they could go any depth upon that principle; it being only a question of a little coal and a little higher pressure,—they had no extra labour. He could do an acre in about 2½ hours. The rope travelled at the rate of about 1½ or 2 miles an hour. The cost per acre, allowing for wear and tear, was 8s. 4d. Four acres could be done within ten hours, at an actual cost of about 25s.; but if he allowed one-fourth for wear and tear, the cost per acre would be 8s. 4d., as previously stated. That was the result of the experiments he had made with his instrument, and it remained only for him to add, that a man could manage it without his (Mr. Smith's) assistance after the first two days, as well as he could manage a team of horses. The time lost in turning the plough was thirty seconds, sometimes, indeed, only fifteen seconds.

Mr. Atkins begged to thank the Society for the kind invitation to be present at that important meeting. Having devoted many years to the subject, and been at considerable expense in developing a plan, he thought he should be seriously neglecting his duty were he to fail in giving the public the little knowledge he had acquired in that direction. In 1843, he entered upon this investigation with the determination, if possible, to solve the problem of steam cultivation. After more than two years' efforts, he succeeded in bringing out a model worked under a patent taken by J. A. Atzlar, of America, which consisted of a process of transmitting power with ropes. The apparatus being complete, he took it to Shrewsbury, in 1845, and, being too late to get it introduced into the Royal Agricultural Society's show yard, he took Mr. King's auction room, and well posted the town and district, inviting the public to attend a lecture and examine the model. He must confess, he was somewhat astonished in the evening, as he had only two Russian gentlemen to attend the lecture. However, having already commenced the construction of a full-sized machine, he had the same completed forthwith. He put it in practical operation at Blackthorn, near Bicester, in Oxfordshire. The principle of transmitting power being established, it only became a question of time, when the application of steam to cultivation should be worked out into practical reality, and having watched its progress to the present day, he must confess he saw no difficulty in its immediate introduction to the public. The diagrams on the wall illustrated his ideas in the simplest form. They would perceive that the arrangement was carried on by an endless rope, and the rope carriers enabled the ropes to adjust themselves on level or hilly land, by the balance weight in the centre. The engine and the rope carriers might be moved on their own wheels by a temporary wooden railway. The space between the carriers and the engine might vary from 50 to 1,500 yards, thus enabling the machine or rotary cultivator to work up and down the land without any obstruction. He believed, on examination, this arrangement would be found of a most simple and inexpensive character, and as 1,000 yards of land might be cultivated with ten cwt. of rope, with a 20 or 25 horse-power engine, he could not understand why a subject so simple might not be put into practical operation. He had devoted more than £1,000, and from two to three years' labour to bring out the idea, and he thought it was to be seriously regretted, that the engineers of this country had not paid more attention to this important subject. He would be glad to co-operate with any party who might feel desirous to make a bold effort to solve the problem. He felt certain, that should a Committee be formed, and an appeal made to the British public, it would be attended with every success. For his own part, he would only say, he would be quite happy to co-operate with such a Committee, and endeavour to bring this subject to a practical realisation. If a subscription should be opened, he would be glad to contribute his quota, as he was only waiting for some effective steps to be taken.

Mr. J. M. Blashfield remarked, that the letter written by Mr. Adams, which had been read by the Secretary, referred to some of the main points of difficulty to be overcome in the first stage of proceedings to plough by steam. One of these difficulties was to provide a shoe, or rail, upon which the engine should traverse, so as to prevent the wheels of the locomotive from sinking into the soil. At present, all the steam-engines used for agricultural purposes, and engines of the same class used for railway making and dock works, are constantly sticking fast from the sinking into the soil of the wheels which carry them. The ploughing engine should be a perfect locomotive, and move itself as well as plough the soil. To do this effectually, a rail and sleeper should be brought beneath the wheel of the engine—that is, the engine should lay down for itself to run upon, a sleeper and rail, and at the same time take it up as it performed its duty. This might be effected by an endless chain of sleeper and rail constructed from the axes of the driving wheels of the locomotive, or working by a ratchet or other contrivance attached at right angles to the inner side of the periphery of the driving wheel of the engine. Such a mechanical arrangement of sleeper and rail might possibly be devised as to work obliquely by an oblate movement rotating on friction balls or rollers. He (Mr. Blashfield) remembered having seen, somewhere in the North of England, a truck, of the sack-barrow character, having a shoe like the folds of revolving shutters for the wheels to run upon on loose ground. These folds of iron revolved with the wheel, and were attached to the axis of the wheel. Locomotive engines of a portable character had been long used for railway, dock, and canal making, but were, for the duty they had to perform, stationary; the defect of proper means to move them from one spot to another had always been felt by contractors, as the wheels readily buried themselves in loose soil. He (Mr. Blashfield) had witnessed the experiment with the American machine for excavating ground, which had been tried on the Great Northern Railway, and the difficulty of bringing it to its point of attack, or place of work, and the joy and exultation expressed by the navigators upon this difficulty. He was convinced that no operation of steam ploughing would be perfect until the engine should make its own roadway, as well as perform its agricultural labour. The same machine that did this would be of great value in forming railway levels, docks, canals, &c.

Mr. T. Scott said, it appeared remarkable to him, and was creditable to the disinterestedness of Mr. Fowler, that he had touched so slightly on the merits of his own invention, although there was little doubt but that it was the wonder of the day, and would in after years be considered *the* invention of the age in connection with agriculture. It appeared to him unquestionably to have given us the basis of steam cultivation, for it had settled the principle and cost of an adequate motive power, that being a stationary portable engine, a few simply arranged and easily adjusted blocks, a windlass, and a wire rope. A ten-horse-power engine under this arrangement could give a slow motion to a machine—for instance, Mr. Fowler's draining plough—requiring one hundred horse-power to move it. Now, suppose the speed of the engine was doubled—say to a good ploughing pace of two miles an hour—and the power thus reduced one half, or to that of fifty horses, and that we took Mr. Fowler's estimate of the loss of power by friction and in drawing the rope. Here we had a clear forty-eight horse-power remaining to draw say twenty common ploughs, or a relative number of other implements. It would thus be seen what an invaluable power this gave us for deep cultivation. Here, then, we simply wanted mechanical adaptation to a special farm or district. But then came the question, who was going to pursue this slow and expensive process of mechanical adaptation further? Mr. Atkins, who had made the nearest approach to realisation, said, he would go no deeper in the mire, having "spent his last penny." Mr. Fowler, too, said, he had made up his mind how much further he would go, which need not create much uneasiness in the agricultural mind, as he was now within sight of the winning goal, having realised an article the value of which, as a commercial speculation, would now induce others to join him. But, what was the case with every other inventor? Their ideas were probably matured, but their mechanical embodiment was in embryo, and their means were gone. If Mr. Atkins was an index to this class of inventors, the dividend seeking public would not join in bringing out their machines. Would it not, therefore, be politic that we should have a national experimental farm, under two or three highly competent commissioners, to put all such inventions to the test and report upon them? Such an institution was suggested to the Highland Society of Scotland twenty years ago, by a practical farmer, and not unfavourably received. As he saw Mr. Fisher Hobbs present, he would ask him, as one of the Council of the Royal Agricultural Society of England, if he thought such an institution would trench on the domain of that Society. He should not discuss the relative merits of digging and ploughing; suffice it to say that there was no necessity for an engine employing the greater part of its power in carrying its own weight over the field; nor was there any chance of its being able to do so at a profit. He had seen Mr. Jasper Rogers' celebrated locomotives for common roads stopped by a little fresh macadamising. Mr. Mechi had stated in detail how a horse's muscular power was expended, and how little was left for labour after what was expended in dragging his own body about. Wire rope, as Mr. Fowler had shown, had lessened the necessity for travelling engines, and Mr. Fowler had satisfied him (Mr. Scott) by carefully recorded experiments with his machinery, that motive power could be obtained by it at an average cost of one half that of horses. This pecuniary consideration was much more likely to induce the adoption of steam cultivation than the economic crotchet that it would save the food consumed by the million of horses now employed in agriculture, for the use of the people. The present cost of horse flesh, as well as all kinds of provender, would no doubt excite increased attention to the subject discussed here to night. As a practical agriculturist, he (Mr. Scott) thought its necessity was becoming as evident as its application to well arranged farms was feasible; and, although there appeared no immediate prospect of its realisation and general adoption, he could not help saying, as Mr. Mechi had done on another occasion, that "his hope was in the future."

Mr. JOHN BETHELL could not allow the evening to close without saying a few words, as his name had been mentioned in the course of the discussion as one of the inventors who had spent his money for the benefit of the human race without deriving any himself. He represented the class of inventors who seemed to have found little favour that evening. His invention was one for cultivating the land with a steam-engine which was locomotive. The digging apparatus was attached to the engine itself, and the engine was fit to be used for all the other purposes of a farm when not required for digging. At first he thought it was a very simple thing, but on bringing his machine into the field he found numerous difficulties. He had been working it for three years with various alterations, and had spent a great deal of money upon it, but he had at last succeeded, and had just ordered drawings to be made for the construction of a new engine, as the field was still unoccupied, for they must admit they had seen nothing that evening which could be represented as a perfect steam digging or cultivating tool. He was unable to lay before the meeting all the details of his plan. He could only simply state that in principle it was the same as was described in his patent of December, 1852—a rotatory digger. It dug like Parkes' steam forks, and left the ground in a perfect state of tilth after the operation; it threw the earth up into the air, the earth falling first, because the heaviest, and the weeds coming upon the surface. They had no difficulty in working about four or five acres a day with that machine. It dug down to the depth of nine inches, and farmers who had seen it working had stated that it did as much in one operation as would require two or three ploughings to perform, besides scarifying, harrowing, &c. The estimated cost of its working was about 9s. an acre, whereas 23s. was stated to be the cost under the ordinary mode. The experimental engine was worked at a pressure of 45lbs., but the one he was about to construct would work as high as 100lbs. to the inch.

Mr. FISHER HOBBS had not intended to make any remarks that evening, but as his name had been mentioned in connexion with the Royal Agricultural Society, he felt it his duty to state that that Society had, for a long time, had under its consideration how the question of steam cultivation could be best promoted. He was happy to say, that a short time since arrangements had been made by the Society to offer a premium of £500 for the best steam cultivator, which would turn up the soil, and become a substitute for the plough and the spade. Knowing as they did that horse power cost them in ploughing £1 per acre, it was clear that if it could be done for less, a very considerable saving would be effected to the country. When they looked at the small amount of the income of the Royal Agricultural Society, not exceeding £5000 a year, they would at once see the importance they attached to this subject when they set aside one tenth of their income to promote it. He thought that even if the Government or Parliament would not take up the subject the public might subscribe such a sum as would assist agricultural engineers and others in making experiments to bring steam cultivation to perfection. He had only made these remarks believing it to be his duty to inform them that in such a movement the Royal Agricultural Society was ready to do its part.

The CHAIRMAN said, it was evident, from the information thrown before them that evening, that for a very long period much attention had been given to this important question, and that something like 60 patents had been taken out in connection with it. It was also very certain —and quite within the pocketable experience of several individuals in that room—that the experiments they had individually made had been attended with a fearful expenditure of money; and for all that expenditure of time, of talent, and of money, it was well to consider to what they had already attained. It was still a question upon which of the various systems there appeared to be most hope of ultimate success, and there appeared to be a fair chance that each might be fairly tried out. Some advocated the original idea of the locomotive travelling over the land and dragging after it the implements in present use modified to the novel purpose; of that class Boydell's steam-horse was an instance. Some contended for a locomotive which should, as a part of the same machine, convey rotatory motion to a new class of implements, by which the soil should be broken up and pulverised; of that class were Usher's and Bethell's. A third party was endeavouring to effect the object by fixed engines, or by portable engines to be fixed in one spot of the field, from which motion should be communicated to rotary machines or cultivators—as exemplified in the system of Mr. Atkins. And a fourth was sanguine as to the results to be obtained from using the general agricultural steam engine, to be fixed in a given spot, by means of a system of ropes working round pullies, by the intervention of a windlass, to draw the ordinary implements, or any suitable modification of them, in straight lines across the field; of that class the experiments of Mr. Fowler and Mr. Smith gave the most evidence of practical success. He (the chairman) did not pretend to give a decided opinion as to which of these systems might ultimately prove the best, but he was strongly inclined to believe that, following out the principle of the use of the present agricultural engine, and the system of ropes and windlass, would lead with the least cost to the earliest development of a practical result. He believed it possible that at some future time the more elaborate plans might be developed to a still more perfect result; but that was not to be obtained until after a long and expensive series of experiments, while the simpler plan would, he believed, show its practical results at a very much earlier period; and the experiments might be conducted by a number of persons who, having steam engines, and requiring no great outlay for new implements, might, without any ruinous outlay, attain a practical and beneficial result; and when once such result should be attained and made public—that by any method steam cultivation might be so conducted as to effect a saving over the use of horses, even if such *method* should not be so perfect as others which might ultimately be developed, great encouragement would be given to stimulate further improvement. He agreed with Mr. Atkins that there existed no difficulty in a mechanical point of view. He did not believe in any engineering difficulty, except the lack of funds, and that was the great difficulty in the present case. The cost of bringing new inventions to bear, was at any time great, but especially great when the introduction of the invention involved, as did that, the accompanying introduction of a new system. It was too costly an experiment, and the beneficial return for that certain cost was too uncertain and too remote for unassisted private enterprise. The remarks they have heard that evening, from those who had made considerable advance went to prove that the time sooner or later was sure to arrive when hope of profit faded, and patriotism was not strong enough (unless, like some of his friends on his left, they had the heart of a lion, and a pocket deep as a well), to induce the further prosecution, always so costly, and sometimes so ruinous. There was no doubt but that steam cultivation might be brought to bear, but it could only be developed by large and costly experiments, and these could only be successfully carried out by some general fund, as they could not be accomplished by individuals excepting at a severe loss, and, in many cases, ultimate ruin. He had now only to move a vote of thanks to Mr. Fowler, not only for his valuable and interesting paper, but for his enterprise, assiduity, and long devotion to the subject. It had only been by the most unwearied exertion, zeal, and talent that he had been enabled to bring his valuable invention to bear. He hoped and trusted he would receive that reward in full which he so well deserved, and which had hitherto been denied to others; and that having proved the advantage of his machine on one branch of the subject—that of draining—he might go still further, and perhaps be the first to prove that the extension of steam to general tillage was less remote than had been generally supposed.

Mr. Fowler thanked the company for the compliment. There was one part of the subject which had been but briefly alluded to—the conveyance of engines from one part of a farm to another. Mr. Boydell had invented a means of readily doing so, upon which further experiments ought to be tried. Mr. Fisher Hobbs had alluded to a public fund for the purpose of making a series of experiments, with the view of ascertaining the best means of applying steam to the cultivation of the soil. He would ask that gentlemen whether the Royal Agricultural Society would take the initiative in raising it. If they would only hold up their little finger for the purpose, he felt assured they would have no difficulty in raising £15,000 or £20,000. They had only to use their influence, and he was certain the public would readily respond to the call.

Mr. Hobbs could only say that he would be happy to bring the subject before the Council of the Royal Agricultural Society. He considered that that Society had never been supported as it ought to be, and that it only required the means to enable it to make most important experiments for the good of the country. He felt with Mr. Fowler that they ought to have an income of £15,000 or £20,000, and if so they could enter upon inquiries which would much benefit the agriculturist and the country.

The Secretary announced that there would be no meeting on the evening of Wednesday next, it being Ash Wednesday. Also, that on Wednesday, the 13th of February, the Paper to be read was, "On the Manufacture of Crown and Flint Glass," by Mr. Henry Chance. On this occasion Mr. Apsley Pellatt, M.P., will preside.

EXAMINATION OF MEMBERS OF CLASSES IN INSTITUTES.

The Council has appointed a General Committee of Examiners for carrying into effect the Society's plan for examination of members of classes in Institutes, followed by the grant of certificates.

Due notice of the details, and the time of holding the examination, will shortly be given in the *Journal.*

SURPLUS FROM PATENT OFFICE FEES.

The following letter, from Sir Joseph Paxton, M.P., was recently laid before the Council, who resolved that it should be referred to a Committee to consider and report thereon, and that the gentlemen whose names appear in the subjoined list should be requested to serve on that Committee:

Rockhills, Sydenham, 3rd January, 1856.

Sir,—As a Vice-President of the Society of Arts, permit me to invite the attention of the Council to the large and constantly increasing revenues derived from the fees paid by inventors for letters patent, and to the mode in which they continue to be misappropriated. It will be recollected that at the last annual dinner of the Society, I referred to this important subject, and I now revive it, because I think that the time has come when it is necessary to take active steps in the matter. The Council is aware that after paying all expenses and fees connected with letters patent, a very large annual surplus arises, which, according to the present arrangement, will be absorbed by the treasury. According to the Report of the Commissioners there were, in 1854, 2,764 patents applied for, and 1,912 sealed, the fees and payments thereon amounting to £53,000. After deducting from this total £8,600 for the law officers of the crown and their clerks, £4,500 as compensation for abolished offices, £3,600 for salaries, &c., in the Patent Office, £4,400 for rent, stationery, &c., and £16,300 as the balance due from the previous year on an extraordinary outlay of £42,000 on the printing of specifications, after, I say, deducting these sums, there still remained a surplus of £15,600.

Now take this present year—of course the Commissioners' report upon its results has not yet appeared, but we know that the total amount of fees payable for patents will be greatly increased—the applications will be about 3,000 in number, and, allowing for a proportion not proceeded with, the total payments may be computed at £60,000. Then, bear in mind that, although under the new law the first cost of a patent is only about £25, to maintain it £50 must be paid at the end of the third year, and £100 at the end of the seventh year. The payments to be made on patents granted in 1852 are now falling due, and calculating that 700, or about one-third of the original number, are considered worth maintaining beyond the third year, there will accrue in this way, during the present year, an increased revenue of £35,000.

Again, supposing that 300, or rather less than half of these, are allowed to lapse at the end of the seventh year, for the 400 that remain there will be a further increase in 1859 of £40,000 per annum. Thus then, without calculating on any probable future increase in the number of patents granted, we seem fairly entitled to estimate the prospective gross revenue from inventors at £95,000 until 1859, and £135,000 afterwards.

This is so enormous a tax upon the ingenuity of the country, the last thing which ought to be oppressed by fiscal restrictions, that in my opinion the attention of your Society, and of patentees generally, should be at once drawn to it, in order to procure a great diminution in the scale of charges for securing patent rights. But even if it is considered that the present scale is not burdensome to individuals, or injurious to the general progress of invention, I submit that there is wide scope for amendment in obtaining such an appropriation of the large surplus which must remain, after deducting all expenses, as will preserve it for the benefit of inventive genius throughout the country, and prevent its being absorbed by the treasury. In order to bring out this point more clearly, let us suppose that the gross revenue of the patent office is accurately estimated at £95,000 till 1859, and at £135,000 from that date.

Taking the accounts of the Commissioners for 1854, it will not be difficult to deduce from thence the probable expenditure, so as to estimate what the net surplus is likely to be. Reckoning the number of patents applied for at 3,000, and the payments computed as above at £60,000, the fees to law officers of the Crown and their clerks would amount to something like £10,000, the salaries of all the officers and clerks in the Patent Office to £4,500, the compensation for offices abolished to £4,500, and the expenses of printing specifications, &c., to £12,000. This makes a total expenditure of £35,000, leaving upon the estimated gross rental of £95,000, as already stated, an annual surplus of £60,000, which will rise to £100,000 in 1859.

Supposing for a moment the foregoing estimate of expenditure and surplus to be taken as it stands, it never could have been intended by the legislature that a direct tax of £100,000 per annum, or even £60,000 per annum, should be imposed upon patentees for the general purposes of the state. A tax to defray the cost of the Patent Office, and give it any amount of increase desirable for the progress of invention, everybody would comprehend, but to place pecuniary obstacles of an unnecessary and burdensome character in the path of discovery and improvement, already sufficiently strewed with difficulties, is upon the very face of it, an unspeakable folly. The title of our Society, assigned to it by charter, has ceased to be appropriate, and the arts, manufactures, and commerce of the country have long since assumed dimensions which enable them to dispense with "encouragement" from any body of men, however zealous, enlightened, or influential. But it does appear to me that we can still do much good, by concentrating attention and bringing opinion to bear powerfully upon such questions as that which I am now endeavouring to place before the Council. I consider that the Society of Arts is bound to exert itself in rescuing this annual surplus from the hands of the Treasury, and I will endeavour to point out not only how in my opinion the money should be applied, but how the Council should proceed in the matter if they concur in my views. Before, however, doing so, it is requisite to point out that the charge upon inventors for securing their patent rights should not exceed what is requisite for maintaining the Patent Office in such a state of efficiency as to make it worthy of this country and to get out of it the utmost possible amount of benefit for those who devote themselves to scientific and practical discovery. I cannot bring myself to think that so large a sum as £100,000, or even £60,000 per annum, of clear surplus, is at all necessary in addition to its present working expenses, in order to give the Patent Office its proper development. Therefore it follows that a very considerable reduction can be effected in the present scale of charges upon patentees.

It is only recently that any serious and worthy efforts have been made to introduce something like order and classification into the Records of the Patent Office, to prepare a good and accurate series of indexes and other facilities for reference and consultation, to open up relations with similar establishments in other countries, to form an industrial library, and to provide at convenient points, not only throughout the United Kingdom, but in the colonies, the means for enabling every man who thinks that he has made a useful discovery to ascertain whether it really possesses the novelty which constitues claim to the exclusive use of it for a limited number of years. Through the liberal interpretation of their duties by the Patent Commissioners, and the valuable labours of Mr. Bennett Woodcroft, their superintendent of specifications, the foundations have been laid for the accomplishment of these objects, and it is obvious that they come fairly within the scope of what persons seeking patent rights may be expected and asked to pay for. I contend, indeed, that much wider ground should be taken than is at present occupied in this way, and that it is disgraceful to us, as a nation, dependent upon our industry and skill for our power, that we should have nothing better to show as the head quarters of British invention than the establishment in Chancery-lane. In an age which boasts that beyond all others, it desires to recognise and do honour to the peaceful arts, can we justify to ourselves the indifference which we have shown to the reputation and fortunes of our great discoverers, men who have conferred more lasting benefits upon their kind than kings or conquerors? I should like to see the Patent Office a place where such interests might be suitably conserved, where the original models of inventions like Symington's steam-engine might be collected, and where our posterity might trace in a great gallery the outward forms and lineaments of those master minds upon whose labours the vast fabric of modern industry mainly rests.

It appears to me, that the body in the Council of which the scheme of the Great Exhibition of 1851 originated, and was elaborated, is better fitted than any other to bring to bear upon the Commissioners of Patents, upon the Government, and on the legislature, such a pressure of influential opinion as shall compel the adoption of those improvements which I have thus indicated in general terms. I have merely sought to open up the subject, to point out the danger of the treasury acquiring a vested interest in a surplus revenue more than sufficient for the great objects of enabling invention to take its flights from the furthest verge of realised discovery, and of securing to it those hardly-earned rights of which it has hitherto been so remorselessly plundered on every hand. It has long been the custom of eminent men to complain of the want of State encouragement, but here will be their true endowment—one resting on the strong basis of public utility, and which all who really deserve it may enjoy without any sacrifice of independence on the one side, or any chance of favouritism on the other. Supposing the Council to concur in the views which I have advanced, I would leave it to them to consider how best they can bring the influence of the Society to bear in accomplishing the objects sought for. It seems, however, to me, that they might take steps to bring together as large a number as possible of the patentees in London and the country, and concert with them what ought to be done. The Commissioners of Patents are entrusted by the legislature with large powers, and what is required is to get them to use these powers as may be best for the interests of the patentees and the progress of inventions.

I have the honour to be,

Your obedient humble servant,

JOSEPH PAXTON.

List of Gentlemen requested to serve on the Committee, with power to add to their number.

W. Bridges Adams.
John George Appold, F.R.S.
W. G. Armstrong, F.R.S.
Francis Bennoch.
Samuel Holden Blackwell.
J. M. Blashfield.
John Braithwaite.
Jacob Brett.
Joseph Burch.
F. Crace Calvert.
Dugald Campbell.
Robert Lucas Chance.
Edwin Clark.
Henry Cole, C.B.
Charles Cowan, M.P.
Frank Crossley, M.P.
Thomas De la Rue.
Bryan Donkin.
William Ewart, M.P.
William Fairbairn, F.R.S.
Benjamin Fothergill.
Sir Charles Fox.
Dr. J. H. Gilbert.
Joseph Glynn, F.R.S.
Prof. Graham, F.R.S.
Peter Graham.
Warren S. Hale.
Henry Hensman.
John Hick.
Edward Highton.
A. C. Hobbs.
S. C. Homersham.
A. H. Houldsworth.
Edward Humphreys.
William Hutt, M.P.
Owen Jones.
John Bennet Lawes, F.R.S.
George Lowe, F.R.S.
Sir John Macneill, F.R.S.
Henry Maudslay.
Charles May.
J. E. Mc Connell.
John Joseph Mechi.
Herbert Minton.
G. F. Muntz, M.P.
Robert S. Newall.
Thomas Page.
Sir Joseph Paxton, M.P.
John Penn.
Ainger M. Perkins.
James Platt.
Richard Roberts.
Titus Salt.
Charles W. Siemens.
Lord Stanley, M.P.
Robert Stephenson, M.P., F.R.S.
J. D. Morries Stirling.
Colonel Sykes, F.R.S.
J. P. Brown Westhead.
Prof. Wheatstone, F.R.S.
Joseph Whitworth.
George Fergusson Wilson, F.R.S.
Edward Woods.
Matthew Digby Wyatt.
T. H. Wyatt.

Home Correspondence.

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PATENT LAW--PRELIMINARY EXAMINATION.

7, Duke Street, Adelphi,
Jan. 4, 1856.

Sir,—It may perhaps not be uninteresting to some readers of your valuable *Journal* to hear a continental voice raised on the important question of a *Preliminary Examination of Inventions*,—a question which at the present time occupies in no small degree the minds of the industrial world in both hemispheres. Allow me, therefore, to address to you these lines, which are less authorised by an extensive and long experience in the matter than by a perfect freedom from bias, and wholly dictated by a wish to impart a little knowledge to others, even at the risk of contradiction from the better informed or more enlightened.

The importance, nay, the existing necessity of a special legislation to secure the same protection to industrial as to any other property, has been generally acknowledged and acted upon by commercial nations. Its exigence, indeed, is so great that those countries which have refused to recognise this truth are standing on the lowest scale of modern civilisation,—a civilisation the general tendency of which is to attain the highest degree of well-being under certain given circumstances. Indeed, which are those countries where these characteristic features of our epoch are mostly to be met with? Evidently they are the United States, Great Britain, and France. All other countries either live, as it were, by loans; follow with more or less ill-will those three great examplars; or, lastly, throw their quotum of genius into the only remunerative market which the world affords, that offered them by those three countries. We shall, therefore, select these States in preference to others, in order to consider the different views of the legislature on so important a topic.

In these three countries the principle of patent-right is equally recognised, and has been acted upon, with some slight modifications, for nearly the same number of years; herein, however, exists the only analogy between the three legislations, and a striking contrast soon appears. Whilst in the United States, the classical country of equality, and inhabited by an ardent, go-a-head people, inventors are obliged to submit their creations to a costly, and in many respects, barbarous scrutiny, the slowness of which can only be corrected by an ever vigilant free press, Great Britain, the land *par excellence* of distinctions and separation of classes, pays an unvarying homage (although surrounded by antiquated forms) to men of genius of whatever origin, and requires from them nothing more than good faith in their applications for protection. France follows the same course, or rather she set Great Britain the example in 1844, whilst the present English legislation traces its origin to 1852, (abstracting of course the different forms, which are rather of an administrative than a political nature). The French legislature, however, with a frankness thought superfluous by the English, marked every undistinguished invention with the enigmatical letters, S. G. d. G. (without guarantee of the Government).

We thus find ourselves in the presence of two systems, the one followed by the Americans, establishing a preliminary examination; the other, English-French, rejecting it.

Now, though in philosophy, poetry, and mere matters of speculation a man may be permitted to be an eclectic, in the prose of life and in everyday pursuits it seems to me highly essential that no one should *loiter by the way*, but pursue steadfastly a given direction. Thus in patent matters we must decide for or against a preliminary examination; we must settle whether or not absolute free-trade principles are to rule the productive and inventive genius of our times. In other words, which of the two systems is preferable—the American system, restrictive, but at the same time presenting more security and guarantees to the patentee, or the French system, which is free from restraint, but, on the other hand, refuses from the very outset every guarantee to the applicant. In putting the question in this way the choice does not present any difficulties, but, as in many things easy answers involve great interests, so in the present case, I think it necessary to investigate the matter a little more closely and as it were historically.

Why has the American legislator thought differently on this subject to his colleague in Europe? In that vast continent, where freedom of action almost equals that of speech, where the democratic element has plenty of elbow-room in the senate as well as under heaven's canopy, unlimited freedom in industrial matters would appear by far more natural than the somewhat continental control actually existing there. And a directly contrary reflection presents itself with respect to France, the country *par excellence* of administrative control, supervision, and bureaucratic drudgeries. This divergency of opinion of the respective legislators reposes rather in the political and social state of the two countries than in the essence itself of the matter. The Americans submit to that kind of control from above because they are an essentially practical people. They are sensible how much it is for the general interest to keep within certain bounds that feverish heat, that high pressure which works their social body,—a body influenced by tradition, but full of heterogeneous elements. Would a settler in Ohio or wild Kentucky, who happened to *believe himself the only and true inventor* of a plough, or a reaper, or a sewing machine, and who had patented the same and saw his neighbour work the invention, would he like to lose his time, which to him is money, by going to law to dispute and settle claims in the ordinary way? I think the chances would be two to one for his taking the law into his own hands, and forcibly putting down that which he sincerely believed to interfere with his own rights. Thus the legislator would have the pain of witnessing a civil suit transformed into a criminal action.

Now all these inconveniences disappear before a preliminary examination, enlightened by a sound public opinion. The inventor's right of priority thus firmly established on legal ground, and the seal of novelty and utility impressed on each invention, by a freely recognised authority, constitutes, as it were, a bill of exchange drawn on the public, which the latter but rarely protests. Herein resides the wisdom of American jurisprudence.

I shall now proceed with the investigation of the subject with respect to Great Britain and France.

And beginning with the latter country, we find things managed in a somewhat different spirit. Indeed the French nation, whose eminently chivalrous and generous spirit rejects all that is exclusive, or might approach to egotism, could not, till lately, conceive the idea of such an exclusive property as that conferred by a patent. Even now, how many people are there in that country who can only perceive in a patent a sort of monopoly or privilege granted to an individual to the injury of the *many*. Thus, until recent times, the watchword (politicians know well its meaning) has been, "War to Patentees," "War to Monopoly," "Down with Barriers." Can it, then, be wondered at that the legislator of 1844 but timidly solved the question by taking away with one hand what he seemed to grant with the other. Thus it came to pass that while granting to inventors a protection of their property (!), he whispered into the ears of those who cried out against a so-called monopoly, "Don't be afraid; you see plainly my friends I do not guarantee anything; I only want to give you sport by starting a stag; 'Hallo! fall upon him!'" Since that time the pack has been opened in France, and more than one stag hunted down because of those horns which were once the pride of his lofty head.

Here I must stop. The subject is of too grave a nature to admit of pleasantry. It is evident that the present state of things in France, with respect to patents, cannot last long, unless the maxims of prudent legislation be entirely neglected. The late Exhibition at Paris has shown with prodigality that the industrial genius of France has taken a stupendous flight. Let the nation beware lest this genius be cast down on a burning sand, or be tempted to wing its adventurous course to more hospitable regions. It is true the times of the edict of Nantes are gone, but it is not yet impossible for human frailty to devise other edicts not less fatal.

The way in which the matter is looked at in Great Britain leads to a kind of *juste-milieu* between the American and French systems, and thus seems to offer a corrective of the vice inherent in the non-preliminary examination. It is true the proud and jealous spirit of self-government which animates the descendants of the rude Saxons in these islands, has removed from the subject every control excepting that which concerns legal formalities. The British government does not, any more than the French government, guarantee the security of property of rights in an invention. But the following are the advantages which the English legislation seems to have over the French legislation.

I. Government does not stigmatise an invention with the cabalistic letters S. G. d. G. (Sans garantie du Gouvernement); as if there were inventions that *are* guaranteed by government.

II. The legal guarantee is extended on the simple ground of there being no priority.

III. That priority may be easily ascertained through the public registers at the Great Seal Patent office, and the official publications of the Commissioners of Patents, including the printed specifications of all previous protected inventions, which it is declared by Act of Parliament shall be deemed and taken to be *primâ facie* evidence of the existence and contents of the documents to which they purport to relate in all courts and in all proceedings relating to letters patent.

IV. If on the one hand government trusts in the good faith of the inventor applicant, who states himself to be the *first* and *true* inventor; on the other hand, it provides him with the necessary means to make his invention quite safe by a *personal* investigation of the *official* works which record all that has been done by his predecessors.

From these remarks, the conclusion may be drawn that with respect to Great Britain the inconvenience of a non-preliminary examination disappears in a great measure, if not altogether, since every inventor, by asking for a provisional protection for six months, may between the date of his application and the time limited for sealing his patent, obtain a legal certainty that he had no predecessors or rivals in his invention, and, therefore, that the latter is quite safe against any prosecution for infringement. The bill of exchange spoken of with respect to the United States, may thus be obtained by inventors in Great Britain,—a country where the respect of property under all its forms is only equalled by the inviolability of law with all its oddities.

I remain, Sir,
Your obedient servant,
A. TOLHAUSEN.
Sworn Interpreter at the Imperial Court of Paris.

CORT'S INVENTIONS.

Sir,—I beg in a few lines to correct some inaccuracies in the particulars hitherto published of Mr. Cort's ruin by the Navy Pay Office. After the publication of my pamphlet on the matter, I received a friendly suggestion that reference to the details of Lord Melville's impeachment, in 1806, for his prolonged private appropriation of public funds, in his office of Treasurer of the Navy, might throw more light upon the original outrage on Mr, Cort, and the subsequent false verdict of the Committee of 1812, than appeared to be shown by the papers so long buried in his family. A search through the extraordinary Parliamentary transactions respecting the Navy Board has indeed thrown a light, which magnifies the Cort case to swelling dimensions. The defalcations of Mr. Jellicoe form a prominent topic through the whole investigations of those gross affairs. It is not often that the ignominious insects of official corruption have the privilege to be embalmed for all ages in the bright amber of beneficial and enduring invention. The deeds of the eminent firm of Trotter, Dundas, and Co., will now be *carried by rail* to the remotest posterity. It would be improper to load your space with details as comprehensive as they are atrocious; my object is to correct some of those which have already appeared, as an imperative justice, for no knowledge can be traced in the Cort documents of the *political* reasons for the inventors destruction. It seems, in the first place, that Mr. Adam Jellicoe was not the partner of Mr. Cort, whence I conceive that the extent in aid upon Mr. Cort's effects was an illegal act. The partner was his son, Mr. James Jellicoe. Secondly, the defalcations were *not* revealed by Mr. Jellicoe's decease. They commenced under the treasurership of Mr. Ellbore Ellis (who left office with an unsettled balance of £300,000 against himself), and were carried through two subsequent treasurerships, with the treasurership of Mr. Dundas, commencing in 1784, when, with an affectation of purity, he promoted the framing of an act for regulating his office, which gave him the precedency and presidency of defaulters, for it was impossible, without his own neglect of his own act, that defalcations could exist except by his sanction. His first act upon entering the office as treasurer was to procure Mr. A. Jellicoe to sign a cheque for £10,000, as if for stores in his department, the proceeds of which Mr. Dundas privately appropriated, and refused to account for. It was impossible to fix the treasurer and his accomplice, Mr. Trotter, with the exact date of their first knowledge of Jellicoe's misdemeanours, in consequence of the notorious release they mutually executed upon leaving office, to prevent either of them peaching upon the other, on which they agreed to destroy, and accordingly destroyed, all the books and vouchers representing the expenditure of £134,000,000 of public money passed through their hands. But Mr. Trotter admits to having known the state of Mr. Jellicoe's balances for *some years*, and Lord Melville knew it at least a year before the extent, for in 1798 Mr. Jellicoe placed in his hands as a security for the deficiency, the patents and contracts of Mr. Cort, and in a memorial presented to the Lords of the Treasury, immediately after Mr. Cort's decease, in 1800, petitioning for an *advantage to himself* for the *very beneficial invention of Mr. Cort*, he excuses his laxity in this defalcation, on the ground of the hope he entertained *that a Parliamentary reward would be granted to their extraordinary merit and advantages*, which sum he looked for as a *fund to discharge this deficit of his treasurership.* So far from Mr. Jellicoe's defalcations having been revealed to his superiors by his decease, the extent in aid was issued during his life, and an account of his effects, estimated at above £80,000, was made out under it by Mr. Banks, an accountant in the Navy Pay Office. On the day *after* the date of this account, Mr. Jellicoe *died suddenly*, as it is alleged, under distress of mind at the desperate intention of ruining Mr. Cort, who he had thus brought to destruction, by a connection formed upon his reputed high character for "uprightness" and wealth; whereas, he was only an adventurer, appropriating public money, after the fashion of his superiors, to purposes of private emolument. It is distinctly stated by Mr. Trotter, in his evidence before the Commons Committee engaged to collect materials for the prosecution, subsequently turned into an impeachment to gain the safe loop-hole of *parliamentary influence*, that Mr. Jellicoe's debt had been leniently considered, on account of the great prospects of satisfactory repayment from his *iron undertakings.* And there appears no reason whatever that dictated to the worthy treasurer and paymaster a different course in 1789. At the period the extent was issued, the new puddling and rolling works at Cyfarthfa and Penydarran had been in successful operation about six months (as proved by a letter in my possession from a man of honour, Sir Jeremiah Homfray). Mr. Jellicoe's prospects of replacing his balances were, therefore, far more certain and immediate at the moment the extent was issued than at any previous period of official lenity towards him. Whether Mr. Jellicoe had irritated or offended his excellent superiors, by refusing his name to any of their private cheques, we can only conjecture. It appears that at least one other cheque for the treasurer's use was procured from him, viz., for £20,000, subsequent to the £10,000, and he may have been reluctant to go on staking his credit in a doubling rate. But there certainly is no evidence of any particular disfavour to Mr. Jellicoe. On the contrary, the extent in aid was only carried out so far as to ruin "the little mill at Fontley;" as soon as this was broken up proceedings were stayed, and Mr. Samuel Jellicoe put into easy possession of his father's residue. This unusual staying an extent in aid, without realising the imperative object of the affidavit, as the only means to save the public from total loss, was closely inquired into by the Commissioners and Committees which investigated Lord Melville's alleged frauds, and it appears to have been skillfully managed. A *temporary* solicitor, (Mr. White) not the regular solicitor to the board, was employed to *begin* the proceedings, and he excused himself for not completing them, on the ground that not being the regular solicitor, he required further special instructions from Mr. Trotter, which *he never had.* If the proceedings had been duly completed, Mr. Cort's liabilities (if in fact he had any with a man *not* his partner) would have been cleared, and he would have remained in possession, not of the little mill at Fontley, for that was destroyed, but of his *patents* and dues, amounting to £185,000 at their expiration.

Every reader can now understand why, in 1812, a Committee, packed under the same "parliamentary influence" which managed to obtain a minority, in 1806, upon Lord Melville's guilt, should have reported in the *greatest haste*, contrary to the *evidence before them*, that Mr. Cort's inventions were of *no value*, that there was *neither novelty nor merit in the principle and application of the puddling furnace and grooved roller.* The climax of that "parliamentary influence," which has been too often the bane of representative government, was reached the year after, when the same House of Commons, in full assembly, attacked with cool resolution the rudiments of arithmetic, and voted that 21s. were equal to 28s.

Had Mr. Cort's grievances been, as hitherto supposed, merely a consequence of apathetic neglect or unconscious ignorance, the case was sufficiently serious for any intelligent nation to have to bear, but what are we to say to it as a systematic persecution, destroying life, character, and rights of property, to screen high-born misdeeds. Lord Melville, after the suspicious destruction, by burning, of documents vouching an expenditure of £134,000,000 of public money, retired into private life with pensions from the public purse of £6,000 a-year. The daughters of the man whose ruin he effected, a benefactor to the whole world as well as his own country, could only be afforded £19 per annum each.

I was told about thirty years since, by one of those quaint pretenders to high philosophy, the astrologers, that learning and science were then entering into the *royal sign.* I presume he knew, or thought he knew, what he meant, and we may certainly console ourselves that there is a change, when we reflect on the distinction which, of late years, has been afforded to intellectual utility by the unprecedented efforts of the illustrious president of your Society, and that the occurrence of such dismal events as I have narrated is become impossible. The day is happily passed, when genius can be publicly trampled beneath the heel of selfish political adventurers, and the redress, as far as may be, of evils perpetrated in those darker times, is equally worthy the animated attention of those enlightened minds who will not only protect the living but do justice to the dead.

I am, Sir, your obedient servant,
DAVID MUSHET.

Jan. 29, 1856.

PROPOSED DIGEST OF PARLIAMENTARY PAPERS.

Leeds, Jan. 30, 1856.

Sir,—Among the various valuable suggestions which have been made to the Society of Arts at each conference of delegates from the Institutions, that for securing a distribution of the more important parliamentary reports and other documents to the Institutions, seems in some danger of being forgotten. One cause of the apparent indifference with which this subject is regarded, arises from the practical difficulties which attend it. In the first place, there is no member of the legislature like the late Mr. Tufnell, actively endeavouring to secure this boon from Parliament. Had Mr. Tufnell lived, the probability is, that some plan of achieving this object would before this have been settled. Even, however, if the legislature granted their papers to the Institutions, and intrusted the selection to a Committee of the Society of Arts, as was suggested, the very valuable information contained in those documents, would be lost to the vast majority of those persons to whom it would be most useful. Although a Committee of selection would, certainly, not trouble the Institution with the custody of documents such as the Hull Bribery Commission inquiry, which nobody ever read, or ever will read, yet there are other parliamentary papers, such as the Sebastopol inquiry, that on the closing of the Public Houses on Sundays, on the Adulterations of Food, and may others, which contain a large amount of most useful and interesting facts most desirable to be preserved, only it is buried under a mass of verbiage and utterly worthless matter of not the slightest interest to anybody. What is wanted, is some compendious document, prepared by competent persons, presenting the important facts and statements in a compact and readily accessible shape.

The recently established union of the Chambers of Commerce, has given birth to a suggestion on the part of Mr. Leone Levi, their London agent, for accomplishing this great desideratum. Mr. Levi is already distinguished by various excellent works on commercial subjects, and no man could be better fitted, both by his knowledge, his previous labours, and his present position of representative of the Chambers of Commerce, to undertake such a task. Mr. Levi proposes to publish "A Digest of the whole business of the Session, with a classified, analysed, and carefully matured review of every social and political question; and present, in a whole view, the mutual bearing of all public documents which now stand isolated and unassisted." The work is proposed to be published in numbers, and in distinct series, distinguishing those relating to finance, commerce, justice, diplomacy, public health, &c., with a view to their being bound together in distinct volumes. It would be issued in bi-monthly and monthly parts during the Parliamentary Session, and at intervals during the recess." Mr. Levi proposes that the whole should be annually comprised in about 1,000 pages of super-royal 8vo., and at a cost of four guineas per year.

The question is, can a sufficient number of subscribers be obtained to warrant Mr. Levi in undertaking this heavy task? There are wanted, at least, 500 subscribers. The members of the House of Commons alone ought to furnish the requisite number. The work ought to be on the shelves of every Mechanics' Institute and every public library. It is one of national importance, and it is the first practical proposal to bring an authentic record of the transactions of the legislature and great departments, in a compendious and available shape before the people.

In my humble opinion, the Society of Arts would render a great public service by taking the work under their especial patronage; let them send a specimen copy of the work to all the Institutes in Union with them, and also to all their members. The Chambers of Commerce ought likewise to take up the subject in the same spirit. It would, indeed, be a pity if so excellent a project fell to the ground for want of support. Sufficient will it be for Mr. Levi to perform the mass of literary labour involved, without running any pecuniary risks in addition.

Trusting my suggestion may meet with your approval,
I remain, Sir, yours respectfully,
JAMES HOLE.
Hon. Sec. of the Yorkshire Union of
Mechanics' Institutes.

INSTITUTION CLASSES AND LECTURES.

Sir,—I regret I was obliged to leave the meeting of Representatives of Institutions in Union, at the Society of Arts, on the 18th inst., at an early period of the discussion, else I should then have taken an opportunity of making the few remarks with which I now beg to trouble you.

As regards the proposed examination of classes, I think there can be no question of the extreme desirability of the course suggested by the Council, and I am glad to perceive the unanimity of feeling in this respect, which pervaded the observations of the gentlemen who spoke on the subject at the meeting, as reported in this week's Journal.

Great difficulties doubtless exist to the establishment of such a general system of examination as is contemplated by the Society of Arts, but the importance of the movement, and the popularity of the measure, will, I trust, be met by the united exertions of those Institutions in Union, whose classes come within the regulations of the Council, to give the scheme a fair and proper trial.

As regards the value of the certificates proposed to be given to successful candidates, I cannot conceive a doubt that such certificates must necessarily, from the care with which they would be distributed, and the high character of the examinations, be regarded as valuable proofs of ability and talent, and employers of labour, whether Government or public companies, or private parties, would surely give due weight to such evidences of qualification for service. The certificates would thus become invaluable passports to employment.

As regards the second subject of discussion, viz., lectures, I am desirous of recording the opinion of my Committee as to their value and importance. At this Institution, which, although numerically small, is comparatively large in its sphere of action and consequent benefits, we have lectures every fortnight during the winter season, and monthly in summer; and in but few instances have we had occasion to remark on the thin attendance of members. We have no doubt of the value of lectures, both as an incentive to the frequent meetings of the members and their friends, and as a means of information and instruction, especially when illustrated by good plans and diagrams, where the nature of the lecture may require them.

We are largely indebted to the Society of Arts for introductions, through the medium of their excellent List of Lecturers, to several gentlemen, whose subjects have given much valuable information, and universal satisfaction to our members, and I take this opportunity of expressing our gratification at the decision of the Council, as announced by Dr. Booth on the 18th inst., to continue this most useful book of reference, although even in the modified form proposed.

Should you consider this letter of any service to the cause, either of class examinations or lectures, I shall feel obliged by your giving it a place in the next Journal.

Yours faithfully,
F. J. MACAULAY,
Hon. Sec. to this Institution, and Chairman of its Managing Committee.

London and South-Western Literary and Scientific Institution,
Brunswick House, Wandsworth Road, Jan. 26, 1856.

CLASSES AND EXAMINATIONS.

Sir,—I see by the Society's Journal that it is intended to promote "the working and formation of classes, with a view to the subsequent examination of the members, such examinations to be followed by certificates as tests of merit in those examined." I think that such a measure (if properly carried into effect, as I have no doubt it will be,) is likely to prove extensively beneficial.
I am, dear Sir, very sincerely,
JOHN RENNIE.

Spring Gardens, 30th January, 1856.

Proceedings of Institutions.

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Bury.—The annual meeting and *soirée* of the members of the Athenæum was held on Tuesday evening, the 15th of January, Mr. John Robinson Kay, President, in the chair. The report, which was read by the Secretary, Mr. Pomfret, stated that the number of members registered during each quarter of the last year was as follows: first quarter, 761; second, 683; third, 599; fourth, 674. For the previous year the numbers were, for the first quarter, 746; second, 758; third, 674; fourth, 850; thus showing that there has been a decrease during the last year. Sanguine expectations are, however, entertained respecting its future progression. There have been added to the library by donation and purchase during the year, 72 volumes. The circulation during the year in the various departments has been as follows: history, antiquities, biography, and anecdotes, 1528; geography, voyages, and travels, 649; mathematics, natural philosophy, and natural history, 730; fine arts, useful arts, and social and domestic economy, 383. In mental and moral philosophy, philology, criticism, and political economy, 425; poetry and the drama, translations from the Greek and Latin classics, 335; novels, tales, miscellaneous and collected works, literary and scientific periodicals, 5536. Total during the year, 9586. The weekly average circulation was 191 volumes. The propriety of establishing in connection with the Athenæum a free library, has for the present been abandoned, in consequence of the passing of Mr. Ewart's bill, providing for the establishment of free libraries in other than corporate towns. The number of daily and weekly newspapers with which the Institution is supplied is 87. The classes generally have been tolerably well attended, and the members are making satisfactory proficiency. The average attendance in the various classes is as follows: junior writing and arithmetic, 39; adult writing and arithmetic, 50; female writing and arithmetic, 12; English grammar and composition, 9. The French class now contains seven members. The amateur drawing class is attended by 11 members. The mechanical and architectural drawing class is in a very prosperous condition. The chemical class consists of nine members. The essay and debating class has been re-organised, with a view to the discussion of subjects calculated to be of most service to the members, in giving an impetus to the desire for acquiring a knowledge of history and general literature. The choral society, under the conductorship of Mr. D. W. Banks, has made considerable progress during the year. The concerts and some of the lectures have been well attended. The financial statement showed that the income during the year amounted to £636 8s. 9d., and the expenditure to £640 19s. 9d.—Mr. Thos. Wrigley moved the adoption of the report, and in doing so expressed regret that the advantages which the Institution had to offer were not seized with more avidity by the operatives in the town.—The resolution was seconded by Mr. James Park, and carried unanimously. A glee having been sung by some of the members of the Athenæum Choral Society, the Rev. Canon Hornby moved, and the Rev. W. R. Thorburn seconded, a resolution declaratory of the advantages to be derived from Mechanics' Institutions.—The Chairman then announced a number of prizes to be given to young persons connected with the Institution, who had made great proficiency. French language, David White; English grammar, John Bentley; writing class, Richmal Crossley and Alice Warburton; chemical class, Charles Whitehead; arithmetic, Hugh Alexander; writing, Henry Bird; arithmetic, Joshua J. Canon; writing, Richard Thompson. The proceedings closed with the usual votes of thanks, and the election of officers for the ensuing year.

King's Lynn.—The first report of the Committee of the Stanley Library, for the year 1855, commences by referring to the constitution of the Library, which is briefly as follows:—Lord Stanley makes a donation of £1000; this is met by an equivalent of £50 per annum from the Corporation of the Borough; £600 is paid for the purchase of rooms in a building, which comprises museum, lecture-rooms, class-rooms, &c., of which sum £300 is taken from Lord Stanley's gift, and £300 is obtained upon a charge of the Corporation gift; the remaining £700 is expended in outfit and books. The governing body consists of a committee of 8, of whom 2 are appointed by Lord Stanley, 2 by the Corporation, and 4 by the subscribers. The subscription is 1s. per quarter, commutable to 3s. per year payable in advance. The subscriber is entitled to take home 2 or 3 volumes, as the case may be; seven days per volume are uniformly allowed for reading, the librarian having a discretionary power of renewal; and a fine of 1d. per day is exacted upon volumes overdue. For those who prefer reading at the Institution, a reading-room is provided, lined with excellent maps and well furnished with periodicals; and both library and reading-room are opened daily from 10 a.m. to 10 p.m., Sundays excepted. The Library is in union with the Society of Arts. The Library opened with a stock of 1,700 vols.; the Committee retaining a portion of their capital in hand until experience showed in what direction additions were most required. The Library now numbers 4,106 vols. Donations have been received from the Theological Book Club of 377 vols.; the Ecclesiastical Architectural Society, 50 vols.; the Conversazione, 74 vols.; and the News-room, 97 vols.; while individual subscribers have contributed 562 vols. The remaining 2,496 vols. have been purchased at a cost of £543 7s. 8d., being an average of 3s. 8d. per vol. A department of books expressly suited for juvenile readers has been added to the Library. A new catalogue has been prepared by the Honorary Librarian (Mr. George Webster,) in which the object has been to furnish, not only a complete index of all the works in the Library, but also of their subjects. There are eleven sub-divisions, and in the arrangement of the Library itself the same classification has been followed. The catalogue will be posted from time to time in MS., but an abridgment only will be published. There are now 782 members, of which number 159 are quarterly subscribers. The average weekly issue has been 1,021 vols.; the greatest, 1,187 vols., and the least 900 vols. The operations of the Library, however, have not been limited to the town. With the express sanction of Lord Stanley, a plan has been announced for establishing rural branch libraries, in connexion with the central Institution at Lynn. Upon payment of an annual subscription of from £1 to £3, a village club is entitled to take out books at the rate of 15 vols. for £1, which are exchanged monthly; thus a subscription of £3 enables a village club to procure the reading of 540 vols. annually, selected by themselves from a collection of more than 4,000 vols. There are already six of such branches in union, numbering about 220 subscribers. The branch issues at present amount to 180 vols. per month.

MEETINGS FOR THE ENSUING WEEK.

Mon. London Inst., 7, Dr. John Tyndall, "On the Nature and Phenomena of Heat."
Chemical, 8.
Entomological, 8.
Tues. Royal Institution, 3, Professor Huxley, "On Physiology and Comparative Anatomy."
Civil Engineers, 8, Renewed Discussion upon Mr. Robinson's paper, "On the Past and Present Condition of the River Thames."
Linnæan, 8.
Pathological, 8.
Wed. London Inst., 3, Mr. Robert Grant, "On Elementary Astronomy."
Geological, 8, 1, Rev. Professor Haughton, "Researches on the Granites of Ireland;" 2, Captain E. Bedford, "On the raised Beaches in the Western Isles of Scotland;" 3, Mr. M. Moggeridge, "On Sections exhibited at the Excavation of the Swansea Docks;" 4, Mr. Consul Miller, "On the late Volcanic Eruption of Manna Koa, Sandwich Islands."
Pharmaceutical. 8.
Thurs. Royal Institution, 3, Professor Tyndall, "On Light."
Zoological, 3.
London Inst., 7, Mr. R. E. Grant, "On the Natural History of Extinct Animals."
Antiquaries, 8.
Photographic, 8, Anniversary.
Royal, 8½.
Fri. Astronomical, 8, Anniversary.
Philological, 8.
Royal Institution, 8½, Prof. H. D. Rogers, "On the Geology and Physical Geography of North America."
Sat. London Inst., 3, Mr. T. A. Malone, "On the Elementary Principles of Animal and Vegetable Chemistry."
Royal Institution, 3, Professor Odling, "On Organic Chemistry."
Royal Botanic, 3¾.
Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette January 25th*, 1856.]

Dated 29th September, 1855.

2170. Henry Bernoulli Barlow, Manchester—Improvements in mules and other machines of the like nature for spinning and doubling cotton, and other fibrous materials. (A communication.)

Dated 15th October, 1855.

2301. John Micklethwaite, Leipzig—Improvement in propelling and steering vessels.

Dated 16th October, 1855.

2309. William Cotton, Loughborough—Improvements in the manufacture of looped fabrics.

Dated 24th October, 1855.

2375. James Smith, Liverpool—Improvements in apparatus for giving alarm signals, and for extinguishing fires.

Dated 23rd November, 1855.

2641. Augustus Dacre Lacy, Hall house, Knayton, near Thirsk—Machinery or apparatus for agricultural purposes, to be used in combination with stationary steam power.

Dated 24th November, 1855.

2647. John Elce and George Hammond, Manchester—The employment of a new material in the manufacture of wicks for moderator lamps.

Dated 27th November, 1855.

2672. Edward Peyton and Duncan Morrison, Bordesley Works, Birmingham—Improvements in the construction of metallic bedsteads and other articles to sit or recline upon.

Dated 29th November, 1855.

2695. James Egleson Anderson Gwynne, Essex Wharf, Strand—Improvements in instruments for indicating pressure or vacuum.

Dated 3rd December, 1855.

2717. Frederick Walton, Wolverhampton—Improvements in papier-maché trays.

Dated 4th December, 1855.

2725. William Hartcliffe, Salford—Improvements in weighting the top rollers of machinery used in preparing and spinning cotton and other fibrous materials.

Dated 11th December, 1855.

2795. John Horsley, Cheltenham—Certain means of treating quinine and iodine, and other mineral medicines, in order to cause them to combine with cod liver oil, or any other fish oil, or with seed oil.

Dated 15th December, 1855.

2838. Samuel Twist, Birmingham—Improvements in casters for furniture and other purposes.

Dated 22nd December, 1855.

2901. James Newman, Birmingham, and William Whittle, Smethwick—Improvements in the manufacture of hooks and eyes, and in machinery to be employed in the manufacture of the hooks aforesaid.

2903. William Stevenson and William Crawford, Lochwinnoch, Renfrew, N.B.—Improvements in machinery or apparatus for carding or preparing fibrous materials.

2905. Isaac Atkins, New Basford, Mary Gate, Nottingham, and Marmaduke Miller, Wollaton-street, Nottingham—Improvements in apparatus for measuring and regulating the flow of gas.

2907. William Henry Zahn, New York, U.S.—Improvements in wind mills or wind engines.

2909. James Chesterman, Sheffield—Improved spring, especially applicable to the joints of knives, razors, scissors, and other like articles.

Dated 24th December, 1855.

2911. Sylvain Mathurin Gillet-Oudin, Blois—Improvements in making bread.

2913. William Symons, Tavistock—Improvements in the suspension roasting jack.

2915. George Lean and Robert Thomson, Glasgow—Improvements in weaving.

2917. Richard Archibald Brooman, 166, Fleet-street—Improvements in treating beetroot and other saccharine vegetable substances, in order to extract alcohol therefrom, and at the same time render or leave the remaining parts of the vegetable fit food for cattle.

Dated 26th December, 1855.

2919. Alexander Tolhausen, 7, Duke-street, Adelphi—Improvements in double-acting pumps. (A communication.)

2921. Franck Clarke Hills, Chemical Works, Deptford—Improvements in economising fuel.

2923. Thomas Duppa Duppa, Longville, Salop—Improvements in generating and heating steam. (A communication.)

2925. Charles May and Edward Alfred Cowper, Great George-street Westminster—Improvements in combing wool and other fibrous substances, and in machinery for that purpose.

Dated 27th December, 1855.

2927. Edward Alfred Cowper, Great George-street, Westminster—Improvements in combing wool and other fibrous substances, and in machinery for that purpose.

2929. Nicholas Douglass, St. George's-in the-Fields—Improvements in the construction of lighthouses, beacons, piers, and other similar erections.

2931. James Edgar Cook, Greenock—Improved composition for preserving exposed surfaces, or surfaces liable to deterioration and decay.

Dated 28th December, 1855.

2933. Jean Jules Robert, 18, Portugal-street, Lincoln's-inn-Fields—The fabrication of torrified beetroot to supersede chicory as used in coffee and with a great superiority.

2937. Paul Marie Salomon, Rue Neuve St. Eustache, Paris—Improvements in the manufacture of gas from peat and in the coke resulting therefrom, and also in the apparatus connected with that manufacture.

2939. William Rowett, Liverpool—Improved mechanical arrangement for lifting weights and other useful purposes.

2941. John Pemberton Turner, Birmingham—Improved method of shanking metallic buttons, applicable to the heading of nails and other like purposes. (A communication.)

Dated 29th December, 1855.

2943. Herbert Redfern, Shelton—Improvements in skates.

2945. John Broadbent and Stanley Peter Youle, Manchester—Improvements in machinery or apparatus for cutting out the gores of umbrellas and parasols, which said improvements are also applicable to cutting out forms or shapes for other purposes.

2947. William Brown, Glasgow—Improvements in cooking and culinary vessels and utensils, and in the application and conveyance of heat.

2949. Silvester Lees and Edward Lees, and George Henry Newton, Oldham—Improvements in machinery for spinning and doubling cotton and other fibrous substances.

2951. William Edward Newton, 66, Chancery-lane—An improved process of tanning. (A communication.)

Dated 31st December, 1855.

2953. Charles Cowper, 20, Southampton-buildings, Chancery-lane—Improvements in the treatment of coal, and in the purification, desiccation, and agglomeration of coal, and in machinery and apparatus for such purposes.

2955. James Taylor, Britannia Works, Birkenhead—Improvements in apparatus for raising and lowering weights.

2957. James Cochran Stevenson and John Williamson, South Shields—Improvements in the manufacture of soda and alkali.

Dated 1st January, 1856.

1. Henry Truelove, Liverpool—Improvements in gloves.

3. John Calvert, Strand—Improvements in extracting metals from their ores.

5. William Beckett Johnson, Manchester—Improvements in steam-boilers and engines.

7. John Thurrell, 32, Castle-street, East, Oxford-street, Elizabeth Mary Muller, 58, Greek-street, Soho, and John Robert Chidley, Gresham-street—Improvements in transmitting fac-simile copies of writings and drawings by means of electric currents.

Dated 2nd January, 1856.

9. William Bullough, Blackburn—Improvements in machinery or apparatus for sizing yarns.

11. George Hamilton, Great Tower-street—Improvements in apparatus for weighing.

Dated 3rd January, 1856.

13. Richard Gill, Grove terrace, Pomeroy-street, New Cross—Improvements in the arrangement and construction of the fire flues and passages of steam boilers, for facilitating and improving the combustion of smoke.

15. Charles Toye, Gloucester-street, Queen-square, Bloomsbury—Improvements in terry fabrics.

17. Joseph William Schlesinger, Northfleet—Improvements in the mode of using emery, glass, and sand, or other substances, or linen or other material, and in the machinery applicable to the manufacture thereof.

23. Alan Stewart, 85, Regent-street—Improvements in measuring the human figure, and in fitting garments thereto.

25. Colin Mather, Salford Iron Works, Manchester, and Charles Millward, Salford—Improvement in steam and vacuum guages.

27. John Fowler, jun., Bristol—Improvements in machinery for giving motion to ploughs and other implements used for cultivating land.

Dated 4th January, 1856.

29. Henry Bernoulli Barlow, Manchester—Improvements in machinery for carding cotton and other fibrous substances. (A communication.)

31. Charles Hart, Iron Works, Wantage—Improvements in portable steam engines, and in apparatus connected therewith, for tilling and cultivating land.

33. Robert Gray, 21, Ridley-place, Newcastle-on-Tyne—Improvements in machinery or apparatus for moulding bricks, tiles, and other similar articles.

35. Thomas Key, Bethnal-green—Improved knife-cleaning machine.

37. Joseph Wright, Burton-upon-Trent—Improvements in furnaces and fire-bars.

39. Joseph Betteley, Liverpool—Improvement in the rolling of iron for the making of ships' knees.

41. Robert Sam North, Derby, and Ralph Peacock, New Holland—Improvements in metallic packings for pistons.

43. William Saint Thomas Clarke, 29, Charing-cross—Improvements in ventilation.

Dated 5th January, 1856.

45. Raymond Kammerer, Ostend, and Charles Brewer, Chelsea—Improvements in electric clocks or timekeepers.

47. Henry Hindle, Cavendish-street, Ashton-under-Lyne—Improvements in valves or apparatus for regulating the flow of steam and gas.

49. Louis Auguste Thérèse, Paris—Improvements in harness.

Dated 7th January, 1856.

51. Victor Delperdange, 125, Rue Verte, Schaerbeck, Brussels—Improvements in metallic and elastic packing.

53. Samuel Cunliffe Lister and William Tongue, Bradford—Improvements in machinery for combing wool, cotton, and other fibrous materials.

55. Richard Archibald Brooman, 166, Fleet-street—Improvements in machinery for boring and excavating. (A communication.)
56. Alfred Vincent Newton, 66, Chancery-lane—Improved mode of manufacturing rods, shafts, and tubes of iron and steel. (A communication.)

Dated 8th January, 1856.

58. Matthias Edward Bowra, 63, Basinghall-street—Improvements in the nature and manufacture of waterproof garments and other goods.
61. Edwin Thomas Truman, Old Burlington-street—Improvements in artificial palates and teeth.
63. Peter Armand le Comte de Fontaine-Moreau, 4, South-street, Finsbury—Improvements in jacquard machines. (A communication.)

Dated 9th January, 1856.

65. John Talbot Pitman, 67, Gracechurch-street—Improved mode of applying diastase and heat to the saccharification of starch. (A communication.)
69. William Barrie, Comm. R.N., Maida-hill, London—Improved reflective leveller. (A communication.)
73. Lambert Alexandre, New York—Improvements in propellers for vessels.
75. William Watson, Leeds—Improvements in the arrangement of furnaces.

Dated 10th January, 1856.

77. Martin Billing, and Frederick Augustus Harwood, Birmingham—Improved machinery for the manufacture of paper bags.
78. John Darlington, Albert-street, Newington—Improvements in the manufacture or production of zinc or spelter.
80. Jane Ann Herbert, 5, Waterden-place, Guildford—Improved method for extracting the dirt, or the gum, or the coloring matter, or the principle from various vegetable or animal substances or materials. (A communication.)

Dated 11th January, 1856.

81. James Fernihough, Dukinfield—Improvements in steam boilers and apparatus for consuming smoke.
82. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in cards for jacquard mechanism. (A communication.)
83. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in railway breaks. (A communication.)
84. Thomas Charles Clarkson, 216, High-street, Wapping—A combination of certain materials for forming and making improvements in ship and other pumps, tubes, and which is also applicable for ship carriage and other building purposes and parts thereof.
85. Alfred Vincent Newton, 66, Chancery-lane—Improved method of curing meats, preserving provisions, and ventilating and cooling buildings, cars, and vessels. (A communication.)
86. William Pole, Storey's-gate, and Frederick William Kitson, Leeds—Improvements in railway wheels.
88. William Routledge, Salford—Improvements in cocks or valves for regulating the flow and pressure of steam, water, or other fluids.

Dated 12th January, 1856.

90. Emile Constantin Fritz Sautelet, Paris—Improved process of tanning.
92. Harry Emanuel, Hanover-square—Improvements in the manufacture of spoons, forks, and other similar articles in metal. (A communication.)
94. Richard Kemsley Day, Plaistow—Improvements in the manufacture of fuel.

Dated 14th January, 1856.

96. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improvements in balanced slide valves for steam engines. (A communication.)
98. Adolf Pollak, Vienna—A new fusee or cigar light.
100. Edward Hammond Bentall, Heybridge—Improvement in the construction of machinery for cutting and pulping turnips and other vegetable matters.
102. Austen Chambers, Canterbury, and William Harrison Champion, Lynsted, Kent—Improved mode of working railway breaks.
104. Anne Emilie Malteste, Paris—Improvements in shirts.
106. William Owen, Rotherham—Improvements in stoves and fire-places.

Dated 15th January, 1856.

108. Joseph Hostage, Thomas Ives Brayne Hostage, and John Tatlock, Chester—Improvements in railway chairs.
110. Thomas Hill Bakewell, Welford-road, Leicester—Improvements in ventilating, warming, and cooling rooms and other places.

Dated 16th January, 1856.

112. Henry McEvoy, Hall Street Works, Birmingham—Improvements in locks, latches, and staples.
114. William Prangley, Salisbury—A novel instrument for exercising the third finger, and thereby facilitating the playing upon musical instruments.
116. John Abraham, Birmingham—Improved machinery for the manufacture of percussion caps, and for cutting out and raising articles in metal generally.
118. Johnson Thompson, Sunderland—Improvements in ships' keelsons.
120. John Fowler, Jun., Bristol—Improvements in machinery for ploughing land.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

122. Henry R. Worthington, New York, U.S.—A machine for measuring the flow of liquids, called a "fluid metre."—16th January, 1856.
160. John Wordsworth Robson, Grundy-street, Poplar New Town—Improvements in machinery appertaining to water-closets and pumps.—21st January, 1856.
170. Dundas Smith Porteous, Paisley—A rotary engine.—22nd January, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed January 25th, 1856.

1692. David Davies.
1695. James Beattie.
1707. Charles Hodges.
1710. William Bridgewater.
1711. Charles Felton Kirkman.
1715. Charles Emile Paris.
1727. Joseph Marie Fillier.
1740. Bashley Britten.
1781. Henri Auguste Pradel.
1801. Edward Cooke.
1817. John Lee Stevens.
1825. James Gardner.
1835. Ebenezer Daggett Draper and George Draper.
1841. Gilbert Sanders and Richard Edward Donovan.
1850. Alfred Vincent Newton.
1856. Joachim Hayward Stocqueler and William James Buchanan Saunders.
1941. William Johnson.
2009. George Collier.
2119. John Page and William Robertson.
2239. William Rogers.
2349. William Field and Edward Jeffreys.
2359. Alexander Parkes.
2377. Jacques Rives.
2427. Henry Edwin Drayson.
2484. Thomas Thomas, jun.
2526. Charles Joseph Hampton.
2535. William Crosley.
2566. Cyprien Marie Tessié du Motay.
2606. Jeanne Barbe Ve Lopez.
2658. Enoch Harrison and Hilton Greaves.
2718. Westley Richards and Joseph Rock Cooper.

Sealed January 29th, 1856.

1735. Nehemiah Brough.
1736. Hall Colby.
1758. Jean Baptiste Mourguet.
1777. John Avery.
1800. Victor Delperdange.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

January 19th.

144. William Riddle.
212. William Tranter.

January 21st.

167. John Medworth and Lawrence Lee.
177. Charles Randolph and John Elder.

January 22nd.

169. Peter Hubert Desvignes and Francis Xavier Kukla.
272. Joshua Murgatroyd.
316. Richard Prosser.
341. Henry Pooley.

January 24th.

197. Nicolas Francisque Ador.

January 25th.

200. John Henry Johnson.
255. Edmund Leach.

January 26th.

210. Robert Shaw.
216. George Edmond Donisthorpe and John Crofts.
217. James Pole Kingston.
218. Thomas Symes Prideaux.
219. John Scott Russell.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3805	January 24.	Improved Tap	Frederick Smith	Birmingham.
3806	January 29.	Rotatory Map Stand	Thomas Poole Alexander Macgillivray	Princes-street, Cavendish-square.